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THE RADIOACTIVITY OF NATURAL WATERS

By W. D. Collins, Chemist in Charge, Quality of Water Division, United States Geological Survey

Every natural water is more or less radioactive, and therefore the recognition of the presence of a small amount of radioactive material in any spring water does not set that water apart from other natural waters.

Knowledge of the presence of radioactive substances in waters is comparatively recent. Therefore, the radioactivity has been seized as something to talk about and advertise as a remarkable and unique property of many waters which are no more unique in their radioactivity than they are in their wetness.

Physicians and others who have given thought to the subject have long recognized that, in general, much better results are obtained from the use of mineral waters at their sources than from the use of the same waters after they have been shipped in bottles. The common explanation has been that at resorts more water is taken, and at the same time the diet and other living conditions of the patient are better regulated than at home. Even without special medical attention at the resort there is usually rest, recreation, and freedom from the normal cares of life.

When radioactivity was first studied and it was found that many famous medicinal waters contained radium emanation, this fact was immediately taken as an explanation of the greater benefits derived from the use of the waters at their sources. The radium emanation is half gone in about 3.8 days after the water has been taken from its source and practically all gone within 30 days. So far the explanation seems reasonable. The first determinations of radioactivity of natural waters were nearly all made on samples from well-known springs. Later studies brought out great differences in the radioactivity of waters that seemed to produce identical beneficial effects and also showed radioactivity to be a universal property of natural water. As the use of radium emanation in the treatment of disease was developed, it appeared that the doses necessary to produce detectable effects could not be obtained by drinking any reasonable quantity of one of the naturally radioactive spring waters; of most waters it would be necessary to drink from 100 to 1,000 gallons a day.

In New and Nonofficial Remedies, 1925, page 308, it is stated that the Council on Pharmacy and Chemistry of the American

Medical Association will not accept any radium solution for internal use the dosage of which is less than 2 micrograms a day, or any radium emanation generator which yields less than 2 microcuries of emanation during each 24 hours.

To obtain the dose of 2 micrograms by drinking 1 gallon of water, which is considerably more than most people drink in a day, the radioactivity of the water would have to be about 500 millimicrocuries [1] per liter. As long ago as 1913 Lazarus, in his Handbuch der Radium-Biologie und-Therapie, stated (p. 200) that, in the use of waters having less than 20 millimicrocuries of radioactivity per liter, the radioactivity probably has no appreciable part in the beneficial effects obtained. It thus appears that the radioactivity should be between 20 and 500 millimicrocuries per liter in order to be considered at all as a factor in the use of a water as medicine, and that even within these limits the radioactivity is not likely to be the controlling factor.

In 1905 Boltwood [2] reported the radioactivity of waters from a group of 44 springs which have been used medicinally for bathing or drinking. The radioactivity ranged from 0.016 to 8.8 millimicrocuries per liter and only two had over 2.5 millimicrocuries per liter. Half of the results were between 0.1 and 0.5. Schlundt and Moore [3] found less than 0.5 millimicrocurie per liter for 40 out of 88 springs in Yellowstone National Park; the maximum reported was 2.68 millimicrocuries per liter.

Measurements by the writer quoted by Skinner and Sale [4] in a discussion of the radioactivity of miscellaneous waters examined in the Bureau of Chemistry gave results ranging from 0.007 to 1.1 millimicrocuries per liter for 15 samples of spring waters collected in 1911, 1912, and 1914 in Virginia, Wisconsin, and Massachusetts. Some of these samples were taken from widely known springs.

The text by Lazarus noted above contains an article by Sommer which gives results of measurement of radioactivity of 422 waters from springs in Germany. The radioactivity of 72 per cent of these waters was reported as less than 2.5 millimicrocuries per liter.

Moore and Whittemore [5] measured the radioactivity of 14 waters at Saratoga Springs, N. Y., and found from 0.039 to 0.88 millimicrocurie per liter. Satterly and Elworthy [6] report the radioactivity of waters from 23 wells and 47 springs in Canada. The results range from

[1] A millimicrocurie is the radioactivity corresponding to one-billionth of a gram of radium (0.000000001 gram). This unit is used in discussions of the radioactivity of natural waters because results expressed in it are numbers of moderate size. Some reports have been made in units of one-tenth to one-thousandth of a millimicrocurie, but all the results quoted in the present discussion have been converted to millimicrocuries.

[2] Am. Jour. Sci., 4th ser., vol. 20, pp. 128-32, 1905.

[3] U. S. Geol. Survey Bull. 395, 1909.

[4] Jour. Ind. and Eng. Chem., vol. 14, pp. 949-950, 1922.

[5] Jour. Ind. and Eng. Chem., vol. 6, pp. 552-553, 1914.

[6] Canada Dept. Mines, Mines Branch, Bull. 16, 1917.

0.0014 to 0.176 millimicrocurie per liter for the well waters and from 0.0112 to 0.64 for the spring waters.

Measurements by O. C. Lester of the radioactivity of 178 mineral waters of Colorado are given in Bulletin 11 of the State Geological Survey, published in 1920. The results range from "none" to 30.5 millimicrocuries per liter. The report "none" signifies only that no radioactivity was detected with the apparatus used and does not indicate the complete absence of radioactivity. Of the waters with measurable radioactivity 85 per cent had less than 2.5 millimicrocuries per liter, 14 per cent from 2.5 to 5, and 6 per cent from 5 to 30.

Other results quoted by the authors cited above serve to show the almost universal radioactivity of natural waters as they occur in the ground and the exceedingly small quantities of radioactivity in even the most radioactive of these waters when compared with the quantities which those who have studied the subject consider necessary to produce any therapeutic effect.

The best available evidence based on scientific studies of the treatment of disease with radium emanation, on measurements of radioactivity of natural spring waters, and on the reported uses of the spring waters, leads to the conclusion that, up to this time, it has not been shown that the small amounts of radioactivity found in natural waters have any effect on the medicinal value of the waters.

THE PHYSIOLOGICAL EFFECTS OF CURRENTS OF VERY HIGH FREQUENCY (135,000,000 TO 8,300,000 CYCLES PER SECOND)

By J. W. Schereschewsky, Surgeon, United States Public Health Service

This paper reports the results of studies of the effects upon small laboratory animals (mice) of electrical oscillations of very high frequency generated by a vacuum tube oscillator.

The modern development of the vacuum tube oscillator and associated circuits permits the generation of continuous wave currents of relatively pure wave form of very high frequency, sharply emitted at the frequency to which the circuit is tuned. This is not the case in the usual type of high frequency apparatus used for therapeutic purposes. Here, the oscillations are produced by condenser discharge across a spark gap. The oscillations produced in this way have a large decrement; the wave form is impure, giving rise to many harmonics; the emitted wave is broad, and consistent operation at the frequencies worked with in the studies here reported is difficult to obtain. Moreover, the oscillations generated are in the form of discontinuous trains separated by a period during which the upbuilding of energy for the next train occurs.

The physiological effects of high frequency currents generated by the vacuum tube oscillator appear to have been but little investigated.

The only reference found by a search through the literature was a report by Gosset, Gutmann, Lakhovsky, and Magrou [1] on the effects of very high frequency radiation emitted by a vacuum tube oscillator upon plant tumors caused in the geranium by *Bacterium tumefaciens*.

The authors report that three geranium plants, bearing tumors caused by inoculation with the above-mentioned organism, were exposed to radiations emitted by a vacuum-tube oscillator at a frequency said to be about 150,000,000 cycles per second. One plant was given 2 exposures of three hours on consecutive days, one plant 3, and one plant 11 such exposures. After 16 days from the first exposure, the tumors, after growing in the interval, began suddenly to necrose. The necrotic process was said to be complete in about 15 days, so that the tumor could be detached by slight traction. In 16 control plants the tumors grew rapidly to enormous size and recurred after surgical excision. Details, however, as to the apparatus and method of exposure are lacking.

In the studies here reported the first step was a study of oscillators which might generate oscillations of sufficiently high frequency and the development of suitable auxilliary circuits in which the effects of such currents on small laboratory animals (mice) might be investigated.

At this point it is desired to express grateful acknowledgment to Prof. George W. Pierce and E. L. Chaffee, of the Cruft High Tension Laboratory of Harvard University, for permitting the use of the facilities of the Cruft High Tension Laboratory in the preliminary work and for much helpful advice; also to Mr. M. L. Dow and Mr. F. H. Drake, of the same laboratory, for collaboration, valuable assistance, and advice in the working-out, construction, and setting-up of apparatus and in making preliminary runs and tests.

Further grateful acknowledtment is made to Prof. M. J. Rosenau, of the Department of Preventive Medicine and Hygiene of the Harvard Medical School, for the use of the facilities of his department in the subsequent work. It is also desired to thank the General Electric Co. for furnishing three special vacuum tubes of low internal capacity.

Description of Apparatus

Vacuum tube oscillator.—After considerable preliminary work in testing the suitability of various types of oscillators, the following types of circuit were settled upon as satisfactory:

For the generation of the highest frequency currents employed, (i. e., from 200,000,000 cycles to 60,000,000 cycles per second) the type of oscillator described by Huxford [2] was found excellently

[1] A. Gosset, A. Gutmann, G. Lakhovsky, and I. Magrou: Essai de Therapeutique du "Cancer Experimental" des Plantes. Comptes Rendus de la Société de Biologie, Vol. 91, 1924, pp. 626–628.

[2] Huxford, W. S.: Standing Waves on Parallel Wires. Physical Review, Corning, N. Y., 2nd Series, Vol. 25, 1925, pp. 686–695.

adapted. In the design of circuits intended to oscillate at these high frequencies, the interelectrode capacity of the tube, negligible at low frequencies, becomes an important limiting factor on the frequency of the oscillations generated. In Huxford's circuit the capacity formed by the tube elements is in series with the variable tuning capacity. Because of well-known physical considerations, this has the effect of reducing the minimum capacity at which the oscillating circuit may be resonated, and thus permits the generation of frequencies

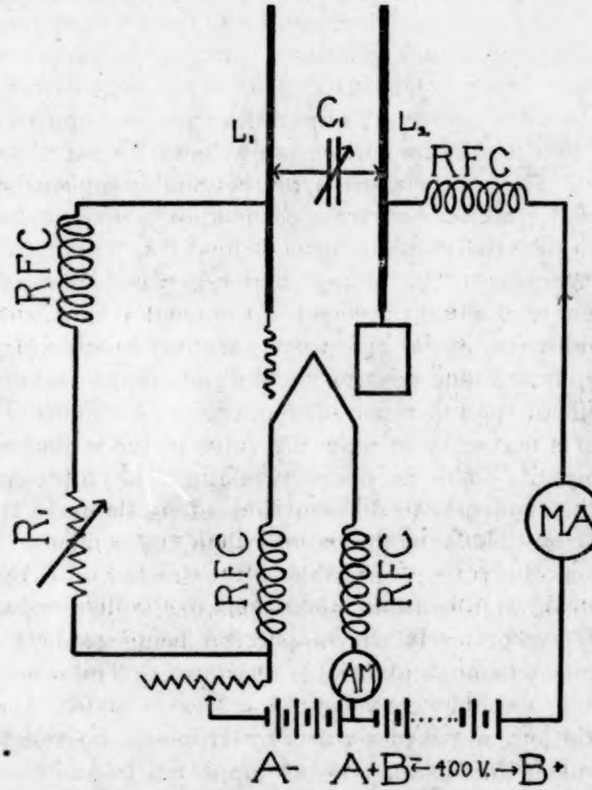


Fig. 1.—Circuit of oscillators Nos. 1 and 2 (Huxford circuit)

L_1, Grid inductance
L_2, Plate inductance
C_1, Tuning condenser
RFC, Radio-frequency choke-coils
MA, Plate millammeter
AM, Filament ammeter
R, Variable resistance (10,000-200,000 ohms)

higher than would be possible with a tube having a given interelectrode capacity, were this capacity in shunt with the tuning capacity as is the case, for instance, in the well-known Hartley circuit.

Two oscillators of the type described by Huxford were constructed, one having a range of from about 200,000,000 cycles to 85,000,000 cycles and the other with a range of 150,000,000 cycles to 60,000,000 cycles per second. Figure 1 shows the circuit network and the accompanying photographs show the appearance of the oscillators.

Reference to the diagram and photograph of oscillator No. 1 (Pl. I) shows that the tuning inductance consists essentially of two parallel brass rods 24 centimeters long, 4.7 millimeters in diameter, and spaced 5 centimeters, supported at each end by vertical bakelite strips. At the vacuum tube end the upper rod is connected to the grid, while the lower is connected to the plate of the tube. This lower rod is revolubly mounted and serves as a support for the rotary plate of the tuning condenser which is mounted on the rod by means of a sleeve and set-screw, so that it may be moved and fixed at any point on the lower rod. The upper rod, which is not revoluble, carries the stator portion of the tuning condenser. This is suspended from a small brass block, bored to a sliding fit upon the upper rod and secured by a set-screw so that it may be appropriately located with respect to the rotary plate. The stator portion of the condenser consists of two plates spaced 3.1 millimeters from each other, with a radius of 4.7 centimeters. The rotary plate has a radius of 3.75 centimeters.

This arrangement of the tuning condenser which permits it to be slid to different sites along the rods is an important means of varying the oscillator frequency, as the range obtained by varying the condenser alone, at any one position on the rods is rather narrow. To get the benefit of the full range of frequencies of which the oscillator is capable, it is necessary to alter the value of the inductance in the oscillating circuit. This is done by sliding the rotor and stator portions of the condenser to different sites along the rods, the inductance in the circuit being a maximum when the condenser is slid as far away from the tube as possible. The farther ends of the rods are connected through suitable choke-coils to the filament and to the plate battery, respectively, the upper rod being connected to the negative filament through a variable resistance. The resistance used was a Bradley, variable between the values of 10,000 and 200,000 ohms. In the circuit, as described by Huxford, no resistance was employed; but in this instance its use appeared to add stability and efficiency, besides, because of its biasing action, reducing consumption of plate current and undue heating of the plate.

As shown in the diagram, the oscillating current was confined to the oscillating circuit by the use of suitable choke coils. These were four in number and were located, one in each leg of the filament, one at the outer end of the lower rod between it and the plate supply, and one at the outer end of the upper rod between this and the grid-biassing resistance. In oscillator No. 1 these choke coils consisted of 23 turns of No. 20 D. C. C. wire wound in a spiral 1.25 centimeters in diameter, each turn being slightly spaced from the next. They were readily made by winding the required number of turns tightly around a ½-inch rod and then slipping them off, the small diameter of the coil and the natural stiffness of the wire rendering

the coils self-supporting. While 23 turn coils were used and found to work well, this number is by no means critical. It could probably be varied several turns in either direction without changing results.

Oscillator No. 2 was a duplicate, in constructional details, of the first oscillator, except for larger dimensions. The rods were 38 centimeters long and spaced 11.5 centimeters instead of 5 centimeters. The tuning condenser, too, was larger, having five instead of three plates. Because of the wider spacing of the rods, it was necessary to make the brass block which carried the stator of the condenser considerably longer than in the smaller model.

It will be noted, from the photograph, that, in the smaller oscillator, no socket for the tube was used, the tube being mounted by inserting the base, until stopped by the pin, in a hole of proper diameter, in a horizontally mounted bakelite strip. The plate, grid, and filament leads were then soldered directly to their respective tube prongs. This was done to avoid introducing unnecessary capacity in the circuit through the use of a socket. In the other oscillators, however, where lower frequencies were generated, this precaution was needless; consequently, for the sake of convenience, a socket was employed.

The vacuum tube used for the generation of high-frequency current was the UX 210. This tube has a thoriated filament, is rated at 7.5 watts, is used with a maximum filament current of 1.25 amperes at 7.5 volts. The plate potential employed was 400 volts, furnished by a suitable number of 6,000 m. a.-hour lead storage-cells.

This tube was found to oscillate vigorously in the circuit just described up to a frequency of 158,000,000 cycles. At this point the internal capacity of the tube and the inductance of its leads were so great that oscillations of higher frequency could not be obtained. However, by the use of the special tubes (shown in Plate II) having a low internal capacity, which were obtained from the research laboratories of the General Electric Co., with the smaller oscillator it was possible to generate effective oscillations of a frequency around 200,000,000 cycles per second, and feebler ones of possibly 230,000,000 cycles.

As shown by the photograph, this tube has the filament and plate leads brought out at the lower end of the tube while the grid lead is brought out at the top. This reduces the capacity between leads within the tube which, in the ordinary type of mounting, may be several micromicrofarads.

Measurements of the internal capacity of this tube made at 1,000 cycles on the Cruft Laboratory capacity bridge showed this to be between 3 and 4 micromicrofarads, less than one-half that of a standard UV 202, 5-watt tube.

While the tubes, when received, were provided with bases, these were removed, by heating, before use so as to reduce the tube capacity to a minimum.

It was found that the generation of these high frequencies was very hard on the tubes, it being necessary, in order to secure adequate output, to increase the filament and plate currents considerably beyond the normal standard. This resulted in burn-outs, cracking of seals, and, in the case of the UX 210 tube, of depletion of electron emission beyond the possibility of reactivation.

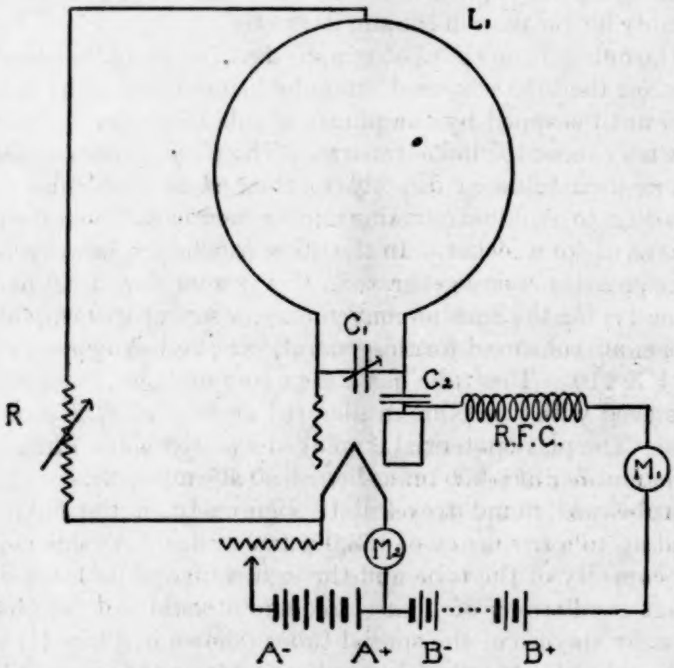
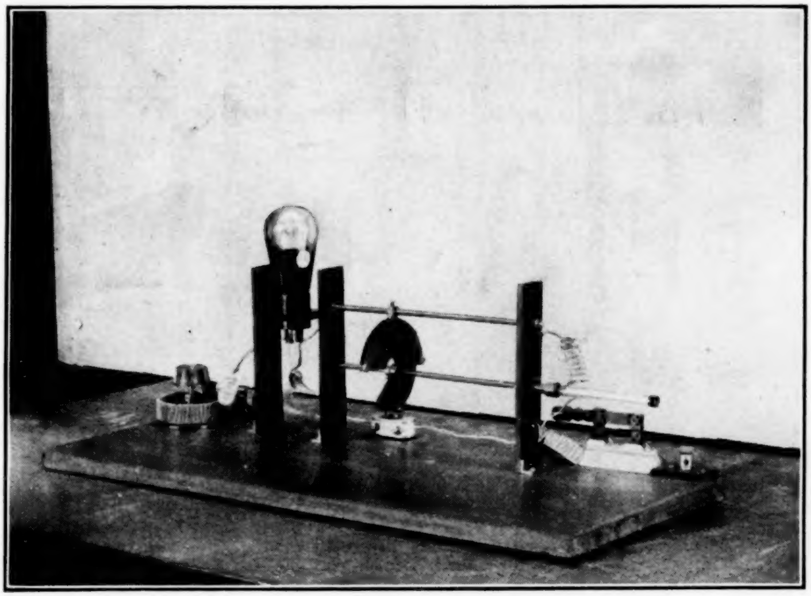
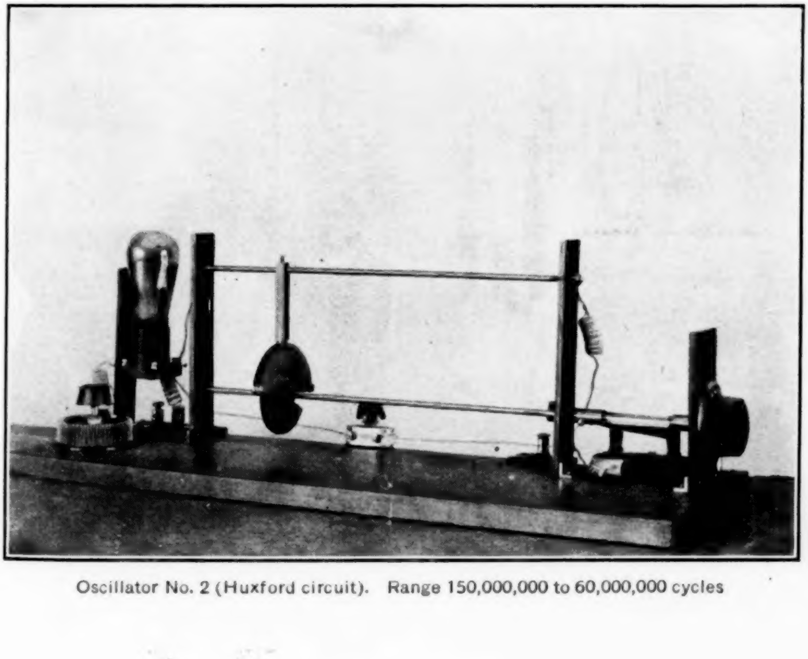


FIG. 2.—Circuit diagram of oscillator No. 3 (Hartley circuit,
L_1, Plate and grid inductance
C_1, Tuning condenser (5-plate and 17-plate)
C_2, Blocking condenser
R_1, Variable resistance (10,000-200,000 ohms)
R. F. C, Radio-frequency choke-coil
M_1, Plate millammeter
M_2, Filament ammeter

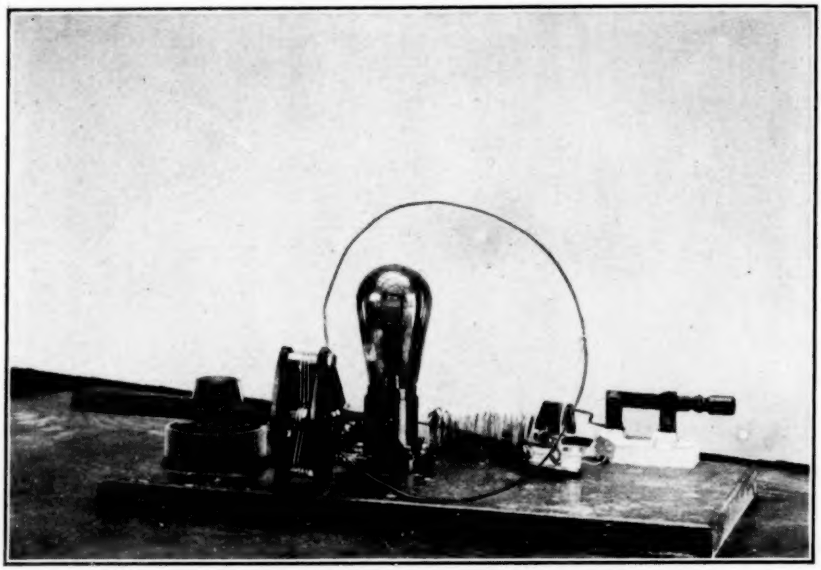
For frequencies of 60,000,000 cycles per second and less it was no longer found necessary to use the type of oscillator just described, which, though reliable and stable in operation, nevertheless, because of limited range was not as well suited to the exploration of the lower frequencies, as the ever useful and efficient Hartley circuit. Consequently, for these lower frequencies, the latter circuit with parallel plate feed, through a choke coil, was employed as shown in Figure 2 and the accompanying photograph.



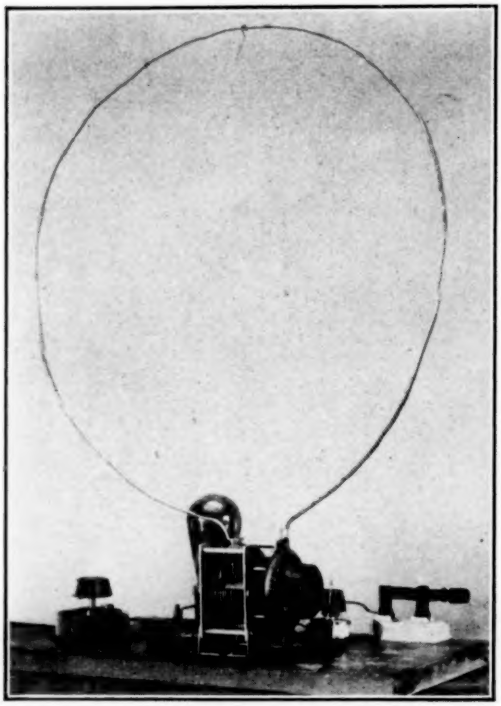
Oscillator No. 1 (Huxford circuit). Range 230,000,000 to 85,000,000 cycles



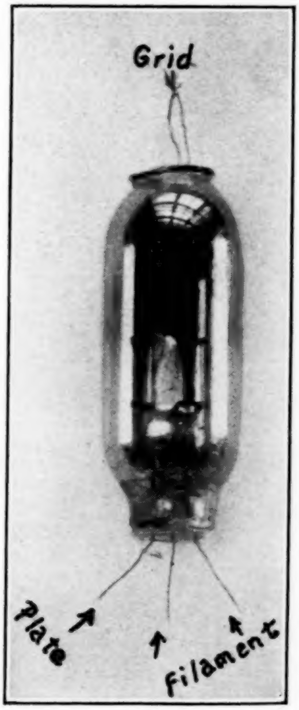
Oscillator No. 2 (Huxford circuit). Range 150,000,000 to 60,000,000 cycles



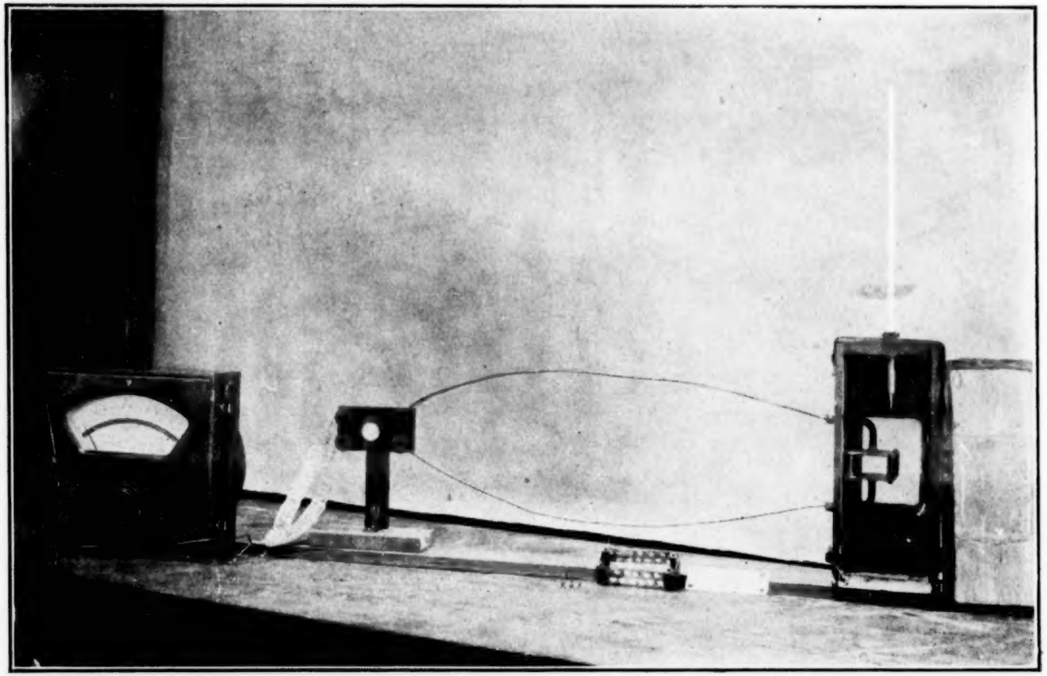
Oscillator No. 3 (Hartley circuit). Range 50,000,000 to 23,000,000 cycles



Oscillator No. 3 (Hartley circuit). Range 20,000,000 to 7,250,000 cycles



Special 5-watt vacuum tube with low internal capacity



Auxiliary-coupled circuit showing mouse holder, thermocouple, and microammeter

For the inductance, single turn loops of No. 14 to No. 4 wire were used according to size and the need for rigidity. These loops, as shown in the photograph, were supported on the tuning condenser (a low-priced 5-plate affair with bakelite end plates which was found to function as satisfactorily as one of the most expensive "low loss" construction).

For frequencies below 12,000,000 cycles, however, a high-grade 17-plate condenser was used. The plate-blocking condenser, a Dubilier micadon, had the value of .00025 mfds. The filament return was taken off the mid-point of the tuning inductance, the connection to the negative filament being made, as in the case of the other oscillators, through a variable Bradley resistance, the usual resistance values used being from 10,000 to 15,000 ohms.

Choke coils of several sizes were inserted in the plate feed, larger choke coils being used for the lower frequencies. As in the case of the oscillators previously described, these consisted of a self-supporting spiral of No. 18 or No. 20 D. C. C. wire, the number of turns varying from 23 to 65 or 70 and the diameter from 2.5 to 4 centimeters, the turns being spaced about the diameter of the wire.

With this type of oscillator, simply by varying the diameter of the single turn used as the inductance, with the 5-plate condenser it was possible to go from 66,000,000 cycles per second (using a 6-centimeter loop) to 10,000,000 cycles per second (using a turn of No. 4 copper wire 76 centimeters in diameter). With a single turn loop 32 centimeters in diameter tuned by a .00035 mfd. condenser, frequencies as low as 7,500,000 cycles could be readily generated.

In all the oscillators the filament temperature was controlled by a 2-ohm rheostat. A Weston ammeter in the filament circuit and a Weston 0–300 milliammeter in the plate circuit indicated the filament and plate currents, respectively. The latter instrument was placed in the negative plate-battery lead and was protected by the insertion of a short strip of ¼-ampere fuse wire.

It was generally found that, for adequate output, the necessary plate current was considerably greater at the higher than at the lower frequencies. At the highest frequencies, during some of the runs, plate current readings of from 100–120 milliamperes were not unusual, but at the lower frequencies from 50 to 80 milliamperes was the usual value.

Frequency determination.—For the purpose of ascertaining the frequency at which the oscillator was operating, use was made of a Lecher parallel wire system. This consisted of two No. 12 parallel copper wires 7.5 centimeters apart and 11 meters long, stretched from standards 29 centimeters above the level of the workbench. Turnbuckles at one end of the wire system served to tighten the wires.

The slider was a rectangular piece of 22-gauge brass plate 12.5 by 8 centimeters, provided with two parallel slots 7 centimeters long and 7.5 centimeters apart to enable it to engage the wires. Supporting sliders of bakelite, grooved to fit the wire and attached front and rear steadied the slider plate, enabling it to travel smoothly. A waxed string passing over pulleys attached to the standards allowed the slider to be moved to any position from the operator's location. A plumb bob suspended by a waxed thread from the slider indicated its position with respect to a wave-length scale laid out on the work-bench beneath. Resonance of the wire system with the oscillator frequency was indicated by a Weston thermogalvanometer connected across the oscillator end of the wires.

In a system of this character, as is well known, standing waves are formed on the parallel wire system in a series one-half wave in length between nodes. If the slider is placed at one of these nodes the wave will travel along the wires to the slider and be reflected back, the total distance traveled being equal to the distance between wave crests, and therefore corresponding to the wave length. When the slider is located in this fashion at a node the meter will show the maximum deflection.

The system is readily calibrated by setting the oscillator at some frequency sufficiently high to permit the development of several successive nodes on the wire system, moving the slider to each of these points in succession and measuring the interval between them; and averaging the measurements which will be found to differ from each other by less than a centimeter. In this way orientation points on the wave-length scale are readily located from which the wave-length scale may be laid out, the wave-length measured, and hence the frequency determined.

Although, owing to the capacity between the wires and also to the surface of the bench, a slight error is introduced, so that the apparent frequency is slightly higher than the actual, still this method of measuring the wave length, and consequently the frequency, is remarkedly accurate, the error probably being one-half of 1 per cent or less.

Since available space permitted a wire system only 11 meters long, wave lengths only up to approximately 21 meters, or frequencies somewhat less than 15,000,000 cycles, could be directly measured. For lower frequencies a wave meter was employed. This consisted of a loop 32 centimeters in diameter made of ⅛-inch brass rod and a high grade .00035 mfd. condenser in series therewith, resonance being indicated either by the lighting of a low-resistance flash lamp bulb in series with the loop and condenser, or by observing the deflection in the plate-milliammeter needle of the oscillator at the reso-

nance point. This latter method was preferred because of the sharpness of the reaction.

This wave meter was calibrated at the Cruft High Tension Laboratory by comparison with the Cruft Laboratory precision wavemeter for this range of frequencies which, in turn, had been calibrated against a quartz-crystal controlled oscillator.[3]

Utilization of oscillator output.—In studying the effects of the oscillator output at various frequencies upon laboratory animals it would obviously be inexpedient to make use of any conductive arrangement, as the constants of the oscillating system would thereby be seriously disturbed. In these studies, therefore, the effects of of these high frequency currents upon animals were investigated by the use of a tuned circuit which was inductively coupled to the oscillator.

As shown in the circuit diagram (fig. 3) and photograph (Pl. III), this tuned circuit consisted of a single-turn wire loop, having a thermocouple (to measure the current) inserted at its mid-point and a capac-

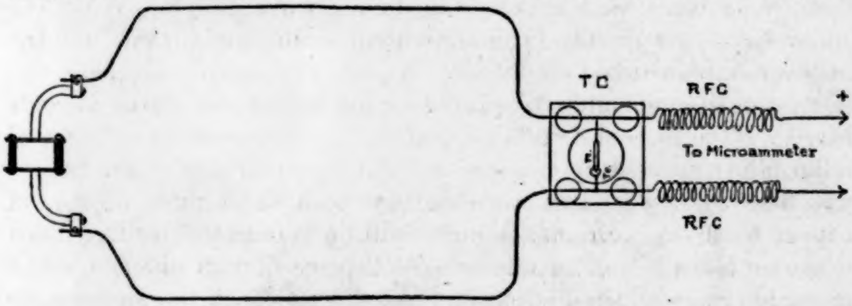


Fig. 3.—Auxiliary-tuned circuit and thermocouple

ity consisting of a pair of rectangular brass plates 7.4 by 4.3 centimeters, 2 centimeters apart. The separation of the plates was rigidly fixed by means of four ¼-inch hard-rubber posts each 2 centimeters long at each corner of the plates. Since it was determined to study the action of the electrostatic field between the condenser plates, to avoid any conductive transfer of energy the inner surface of each condenser plate was covered with a celluloid sheet 0.004 inch in thickness. The subject for experimentation (a mouse) was placed in a small celluloid box with perforated sides (see Pl. III) and inserted between the condenser plates where it fitted snugly.

The dimensions of the condenser given above were not the result of any calculation, but were determined by the size of the celluloid box which was designed to hold a 20–22 gram mouse comfortably without, at the same time, permitting it to turn and twist too freely. The box consisted of two pieces of stout celluloid for the top and bottom, held

[3] See: Piezoelectric Crystal Resonators and Crystal Oscillators Applied to the Precision Calibration of Wave-meters. By George W. Pierce. Proceedings of the American Academy of Arts and Sciences, vol. 59, No. 4.

apart by ¼-inch hard-rubber posts to which they were secured by short screws in holes tapped at each end of the posts. The sides of the box were covered in with strips of stout celluloid perforated with numerous ¼-inch holes for ventilation, glued to the hard-rubber posts by means of cellulose varnish.

While mice of from 19–22 grams in weight fitted snugly in the box, so that they could indulge in but moderate twisting and turning about, still, confinement in the box was apparently not uncomfortable per se, as mice frequently went to sleep when undisturbed. Confinement in the box of several hours' duration was without effect upon mice.

The capacity of the condenser without mouse or mouse holder was found to be 4.1 micromicrofarads. Putting the empty mouse holder in place increased the capacity to 8.1 micromicrofarads. With a 20-gram mouse in the holder the capacity increased to 16.1 micromicrofarads. These measurements were made at 1,000 cycles on the Cruft Laboratory capacity bridge. The capacity of the condenser with mouse holder and mouse was, therefore, about four times greater than the capacity with air alone as the dielectric.

Current measurement.—The amount of oscillating current induced in the auxiliary-tuned circuit was measured by means of a platinum-tellurium thermocouple which was constructed for the writer by Mr. F. H. Drake, of Cruft Laboratory. This consisted of a bit of tellurium supported upon a piece of 22-gauge nickel wire to which it was fused. This in turn was soldered to a short piece of No. 18 copper wire. A piece of 7-mil. platinum wire was rolled to a ribbon approximately 1 mil. in thickness. A piece of this about 1 centimeter long was soldered at one end to a short piece of 18-gauge copper wire, while the other end was made somewhat pointed by means of shears. The pieces of copper wire to which, respectively, the platinum ribbon and the tellurium were attached were mounted vertically, through holes in which they were a tight fit, on a stout piece of bakelite at such distance apart that the pointed end of the platinum ribbon fell naturally about on the center of the tellurium fragment. Upon passing direct current regulated by a variable resistance from a 6-volt storage battery, the platinum ribbon was heated to redness. The tellurium fused at the point of contact and thus became solidly welded to the platinum ribbon. A cap fitted over the thermocouple protected it from the effect of air currents. The circuit diagram of the thermocouple is shown in Figure 3.

It will be seen that the thermocouple is connected across two conductors, two ends of which form part of the auxiliary-tuned circuit, the other ends being connected through choke coils to the plus and minus posts of a Rawson microammeter. This instrument had a resistance of 52 ohms and a full scale reading of 120 microamperes.

The resistance of the thermocouple was found to be 0.3 ohms at 1,000 cycles.

The thermocouple was calibrated on 60-cycle A. C. by noting the scale reading of the microammeter for various current values as determined by the voltage drop across standard resistances measured by a Rawson vacuum thermocouple voltmeter. The full scale read-

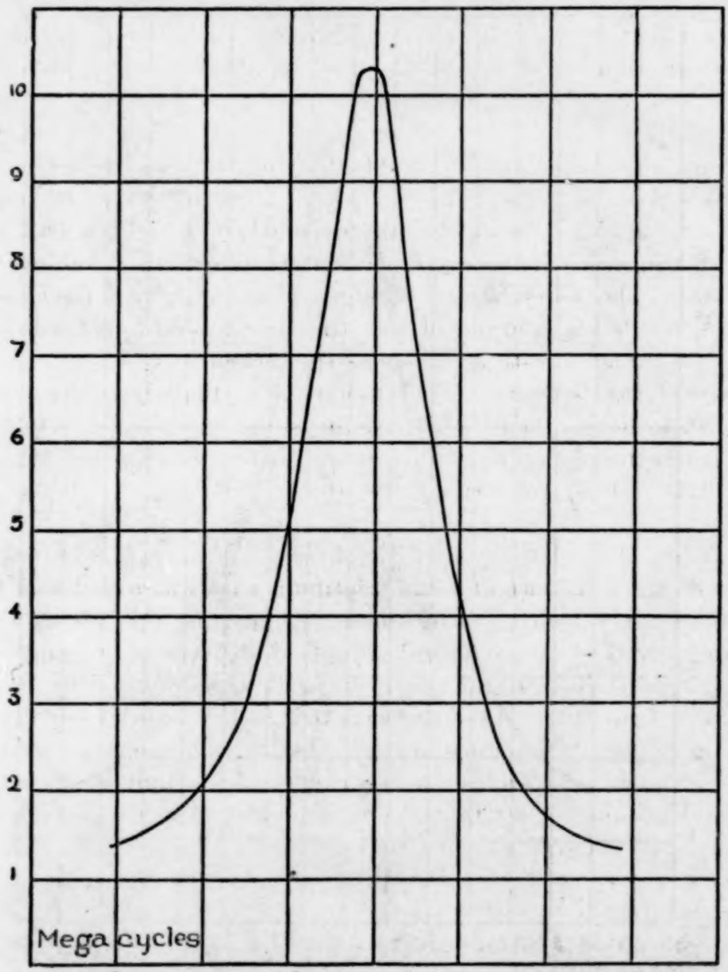


FIG. 4.—Resonance curve of auxiliary-tuned circuit with 20-gram mouse. Peak at 10.42 megacycles

ing of 120 on the microammeter corresponded to 0.61 amperes. At 5 on the scale the current was 0.139 amperes.

The calibration of this thermocouple was checked at frequent intervals throughout the study and remained unchanged.

Tuning the auxiliary circuit.—Since the output of the oscillator was applied to the experimental animals, by means of the current

induced in the auxiliary circuit placed in inductive relation to the oscillator, the first step in any experiment was, of course, to tune the coupled circuit to the oscillator frequency so that the current in this circuit should be a maximum. To do this, a mouse immediately after death by gas was placed in the celluloid box and inserted between the condenser plates. A loop was then formed by joining with

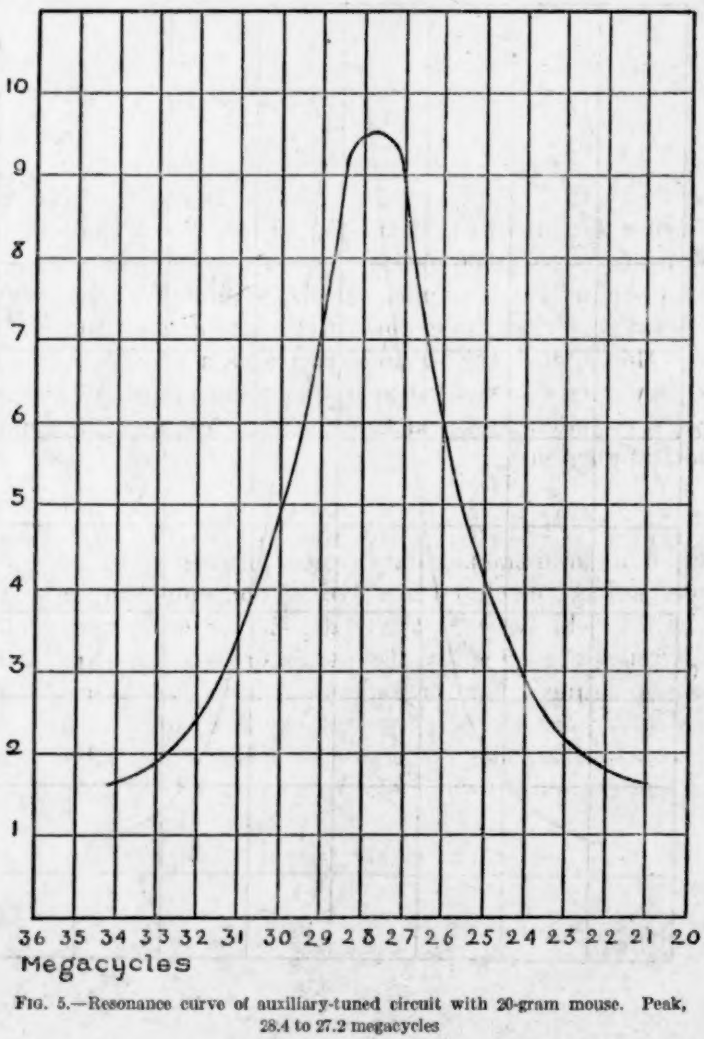


FIG. 5.—Resonance curve of auxiliary-tuned circuit with 20-gram mouse. Peak, 28.4 to 27.2 megacycles

two pieces of stiff wire the high frequency terminals of the thermocouple with the corresponding condenser terminals. As a first approximation the length of wire was arbitrarily chosen at a value which experience showed to be about the length desired. Then by starting the oscillator and varying its tuning condenser until maximum current was flowing in the coupled circuit, upon determining the fre-

quency an idea could readily be had of how closely the auxiliary circuit was tuned to the frequency it was desired to study. With this information it was easy to add or to subtract wire from the auxiliary circuit as required, fine adjustment being finally made at the condenser terminals by loosening the set screws which held the wire in place in holes in the arms supporting the condenser and adjusting the length of the inductance by pushing the wires in or pulling them out of the holes. The graphs (Figs. 4 and 5) of the resonance peak of the tuned auxiliary circuit measured at 10,400,000 cycles, and at 28,400,000 cycles, give a good idea of the type of resonance obtained in this circuit.

It will be noted that the circuit tunes more sharply at the lower frequency. In this case the peak of the resonance curve is about 180,000 cycles broad, while, at the higher frequency, the breadth of the peak is about 1,200,000 cycles.

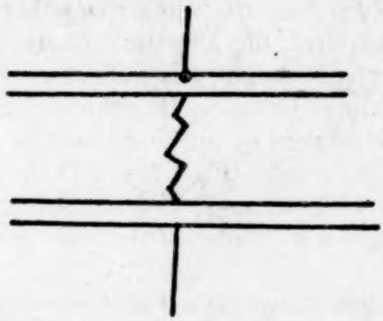
We may, therefore, conclude, since the tuning of the auxiliary circuit is rather broad, that this circuit presents considerable resistance. Hence, only approximate accuracy is necessary in setting the auxiliary circuit to resonance as the current flowing through it, when tuned to somewhere near the oscillator frequency, is ample for experimental purposes.

Effects of Exposure on Laboratory Animals

It will be noted in the auxiliary circuit just described that the experimental animal, insulated in a box of nonconducting material, is placed in the field between the plates of the condenser while the coupled circuit is excited by the oscillator at some particular frequency. Consequently, no free electrons from the external metallic parts of the circuit can enter, nor can they flow out from the body of the experimental animal. The mouse, however, is subjected to a displacement current, in which electrons in the molecules of the body cells will, according to their state of freedom, either pass from molecule to molecule, first in one and then the other direction or, if bound, are stressed in a direction the polarity of which alternates at the oscillator frequency.

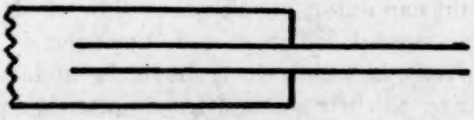
The equivalent electric circuit presents at least two possibilities. The first and more probable possibility is that the system may be regarded as two condensers in series connected by a resistance, the first condenser being formed by one plate of the condenser and the body surface of the mouse, in close proximity to it, the intervening celluloid acting as a dielectric. The second condenser is formed, in

similar fashion, by the lower surface of the body, the intervening tissues acting as the connecting resistance thus:



That this equivalent circuit is probable is shown by the fact that we can readily substitute in place of the mouse two metallic plates connected with each other and spaced far enough apart to fit snugly against the top and bottom of the box. It was determined experimentally that two rectangular copper plates each 2.5 by 2 centimeters and spaced 2 centimeters by a connecting copper strip furnished an electrical equivalent for a mouse. If the coupled circuit were tuned to the oscillator frequency with this arrangement in the box, it was found to be approximately in tune if a mouse were substituted. However, the coupled circuit with the substitute in place had naturally a much lower resistance than with a mouse, so that the current registered for a given filament temperature was considerably higher.

Another possibility is that the mouse's body acts in the circuit as a dielectric of poor quality. In this case the electric equivalent would be a condenser shunted by a resistance as shown below.



It has already been mentioned that the insertion of the mouse holder containing a 20-gram mouse between the condenser plates increased the capacity about four times. The effect of the presence of the mouse holder and mouse on the tuning of the circuit is well shown in the following way. When the auxiliary circuit, with the mouse in place, is tuned to the oscillator's frequency, if the mouse holder and mouse are then removed the needle of the microammeter, indicating the current in the tuned circuit, drops to zero. If the oscillator be tuned to resonance with the circuit in this condition, the frequency will be found at a point considerably higher.

In this case, as might be expected, with a perfect dielectric, as air, filling the space between the condenser plates, the resistance of the

circuit is lower, so that the resonance peak is sharper and the current flowing greater for a given oscillator output.

While it may well be that the electrical behavior of the mouse in the circuit partakes of both modes of action just described, still, on the whole, the first state of affairs described seems the more likely.

Effects upon laboratory animals.—Exposure of small laboratory animals, such as white mice, in the manner described, to the rapidly oscillating field between the condenser plates of the auxiliary tuned circuit, causes death usually in a few minutes if the current value be sufficiently great.

The symptoms observed are, in general, as follows: For a short, variable time the mouse is quiescent. This is followed by agitation increasing with the length of exposure. The ears, tail, and paws turn a bright pink which, in many instances, becomes livid or cyanotic as the exposure is prolonged. There is salivation, the nasal secretion is increased; the head and under parts of the body become wet and bedraggled; the paws are covered with beads of moisture. After a variable time convulsions accompanied by convulsive winking take place, dyspnea sets in, and finally respiration ceases. In males there is usually considerable swelling of the genitalia. The heart, however, continues to beat for a little while after respiration ceases.

In the great majority of instances the body of the mouse appears distinctly warm to the hand, and if the rectal temperature be taken immediately after death considerable elevation in the body temperature is found to have taken place, the temperature varying from 42.2° to 43.1° and even 44° C. However, this is not always the case, as death was repeatedly observed to occur in the usual time, and yet the elevation of the body temperature was only moderate, in one instance the rectal temperature not exceeding 39.2° C., a temperature which is not infrequently observed in apparently normal mice. However, in the majority of instances the exposure has caused considerable elevation of the body temperature and we may infer that the primary fatal effect observed consists in raising the body temperature to a degree incompatible with life.

Since the rectal temperature of a normal mouse, according to the temperature of the environment, may be anything from less than 37° to about 39° C., the exposure has brought an increase of the body temperature of anywhere from 5° to 6° C.

In the case of mice, however, which had been killed by exposure to carbon monoxide gas, and then immediately exposed in the coupled circuit, the heating effect was far less pronounced. In dead mice it was found, using the same current and time of exposure necessary to kill living mice at that particular frequency, that the

rise in the body temperature of the dead mouse was of a much lower order, amounting to but 0.7° to 1° C. In many instances there was no gain, and in others a loss was recorded.

This would suggest that the heating effect is different from the diathermic effect observed at the lower frequencies used for therapeutic purposes, as by the use of high-frequency current in diathermic apparatus it is easy to raise the temperature of dead tissues well above the point at which albumen coagulates.

However, at certain frequencies considerable heating effect was observed even in dead mice. Thus, at 6.6 meters, or a frequency of 45,000,000 cycles, 3 dead mice, as the result of exposure lasting 8.5 minutes, showed gains in the rectal temperature of 2.33° 3.6° and 4.4° C., respectively.

Sequelæ of exposure to sublethal doses.—Apart from the acute symptoms previously mentioned exposure to these high-frequency currents may cause destruction of tissue. After sublethal exposures, in many instances, small hemorrhagic areas may be observed along the course of blood vessels of the ears. In the course of 48 hours the ears become necrotic and drop off. The tail also often presents numerous ecchymotic areas. It may subsequently become affected with dry gangrene and drop off. In other instances areas of alopecia develop, particularly in the supra-orbital region or at the tip of the snout. In one instance a panophthalmitis developed with subsequent loss of vision.

Effects of change in frequency.—In preliminary observations it soon became evident that the effects of exposure to different frequencies was not the same, a current of constant value proving more lethal at some frequencies than at others. Furthermore, the change in lethal effect did not appear to bear any simple relation to change in frequency, as one would be led to expect, so it was determined to study the changes, if any, in the lethality of a constant current as the frequency changed. Since part, at least, of the effect of the exposure was due to increase in the body temperature which, in turn, might be modified by changing external temperature conditions, it was evident that, to avoid serious error, the observations must all be made under substantially constant meteorological conditions.

The standard conditions of temperature and humidity at which to conduct the experiments were arbitrarily fixed at 24° C. and 40 to 42 per cent relative humidity, as these represented a fair average of the atmospheric conditions at which preliminary observations were made.

To secure these conditions, the apparatus depicted in Figure 6 was set up. As will be seen from the diagram, it consisted of the following parts:

The condenser, in the field of which the mouse was exposed, was mounted in a wooden box 22 by 10 by 9.5 centimeters outside dimen-

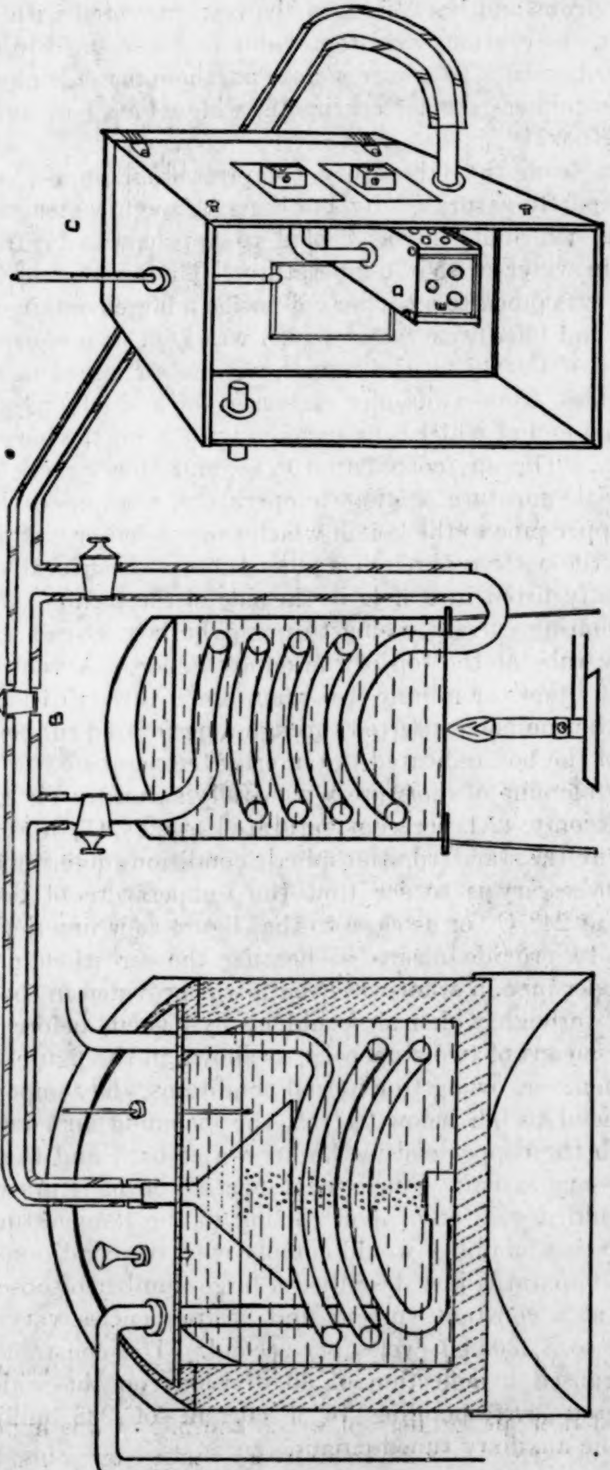


FIG. 6.—Constant temperature and humidity apparatus. A, Humidifier; B, Hot-water bath; C, Box containing condenser; D, Condenser; E, Mouse holder

sions. The front and back sides of the box, provided with celluloid windows for observation, were removable and were held in place by stout rubber bands. To secure a close fit, the inner side of each was fitted with a rubber gasket 1 centimeter wide which bore against the edges of the box.

Air taken from the laboratory compressed-air supply was first cooled and partly saturated by bubbling through water in a large wash bottle, which itself was cooled to approximately 10° C. by immersion in water of that temperature. The air issuing from the wash bottle was piped to a copper coil inside a large container packed in sawdust and filled with water which was kept at a constant temperature of 10° C. From the copper coil the air issued in a stream of fine bubbles, from a bubbler consisting of a small, weighted tin can, the open end of which was covered with 8 or 10 thicknesses of butter cloth. The air, cooled to 10° C., and thus practically fully saturated with moisture at that temperature, was piped through a jacketed copper pipe to the box in which the condenser was mounted, entering at the bottom through a glass tube in a perforated rubber stopper tightly fitted in a hole in the side of the box.

The ventilating current, rising through the box, issued through a similar glass tube at the top of the opposite side. A ventilation of about 8 to 9 liters per minute was maintained through the box. A centigrade thermometer inserted through a perforated rubber stopper in the top of the box indicated the interior temperature.

Since the amount of moisture which fully saturates air at 10° C. will leave it only 42.1 per cent saturated at 24° C., it is obvious that, to secure the standard atmospheric conditions determined upon, all that is necessary is to see that the temperature of the box is maintained at 24° C., or as close to that figure as is practicable.

In order to provide means of heating the air when necessary, a coil of copper pipe in a hot-water bath was provided in the vicinity of the box, through which air could be by-passed, before reaching the box, by means of two stopcocks, as shown in the figure. In this manner, whenever, owing to external conditions, the temperature of the box tended to fall below 24° C., the incoming air could be led first through the copper coil in the hot-water bath and thus heated to the necessary extent. Since, when heated, no moisture would be lost, nor could it gain any, upon cooling to the temperature of the box, the relative humidity would comply with the conditions.

With the apparatus just described a large number of observations were made at a constant current and at frequencies varying from 135,000,000 to 8,330,000 cycles per second. The constant current employed caused a deflection of 30 divisions on the scale of the microammeter, corresponding to a current of 338 milliamperes flowing in the auxiliary tuned circuit.

This value of current was chosen because preliminary observations had shown that, at lethal frequencies, this current value always caused death in 10 minutes or less. In the great majority of instances ten mice weighing between 19 and 22 grams were used successively at each frequency and sometimes more were used.

The difference in frequency employed was in the neighborhood of 10 per cent. This accounts for the fact that many of the frequencies and wave lengths given in Table 1 are not integers. In that table are set forth the frequencies at which observations were made, the number of observations, the average time elapsing before death, the maximum time, the minimum time, and the usual time.

TABLE 1

Frequency times 10^6	Wave length	Number of observations	Average length of survival	Minimum length of survival	Maximum length of survival	Usual length of survival
	Meters		*Minutes*	*Minutes*	*Minutes*	*Minutes*
135	2.22	8	26.4	16.5	[1]	21 -25
121.5	2.47	10	20.1	13.5	26.5	20 -22.5
110	2.73	10	15.9	11.5	20.0	17
99	3.03	11	15.6	9.25	23.0	14.5-16
90	3.34	12	10.9	8.0	17.5	9 -12.5
81	3.7	9	9.9	7.0	16.5	8 -10.5
73	4.11	10	9.5	6.5	15.5	9 - 9.5
66	4.54	10	7.7	6.0	9.0	7 - 8
60	5.0	9	8.0	5.5	9.5	7 - 9
55	5.44	10	9.25	5.0	12.0	9 -10
50	6.0	6	9.37	7.0	11.0	8.5-10
45	6.66	14	7.8	4.5	10.5	7 -8.5
42.8	7.0	5	8.1	6.0	11.5	7 - 8
40.1	7.25	10	7.6	6.0	9.5	7
35	8.51	16	9.1	6.5	14.5	7.5- 9.5
30	10.0	10	8.5	7.0	10.5	7.5- 8.5
27	11.11	10	6.65	5.0	8.0	6 - 7
24.3	12.3	10	10.52	8.5	14.0	9.5-10.25
22.22	13.5	13	7.8	5.0	12.0	6.5- 7.5
20	15.0	12	8.27	6.0	11.5	7 - 8.5
18	16.6	15	6.95	4.5	9.5	5.5- 6.5
16.2	18.5	11	7.1	5.5	11.5	6 - 7.5
14.6	20.55	9	11.3	7.75	15.0	10.5-12
13.7	21.9	10	10.6	7.5	16.5	10 -12
12.33	24.4	10	14.25	9.0	19.5	12 -14.5
11.1	27.0	11	14.5	8.0	19.5	12 -13.5
9.93	30.2	10	9.65	6.5	14.0	8 - 9
9.2	32.5	9	11.5	7.5	17.0	10 -11.5
9.0	33.3	10	23.5	15.5	[2] 35.0	22 -30
8.5	35.3	11	17.2	11.0	[3] 30.0	16 -18
8.33	36.0	11	17.7	11.5	32.0	16 -19

[1] 1 mouse survived 43 minutes unaffected.
[2] 3 mice survived 35 minutes unaffected.
[3] 1 mouse survived 30 minutes unaffected.

The average time of survival plotted against frequency is graphically shown in the chart which accompanies the table.

It will be seen from the graph that, starting at a frequency of 135,000,000 cycles per second, with a constant current maintained in the auxiliary circuit of 338 milliamperes, the lethality increases until at 66,000,000 cycles the mean time of survival has been reduced from an average of 26.8 minutes to one of 7.7 minutes, a reduction of 71.3 per cent. From this point, with a fluctuation of a minute or so in the mean time of survival, the lethality of the various frequencies

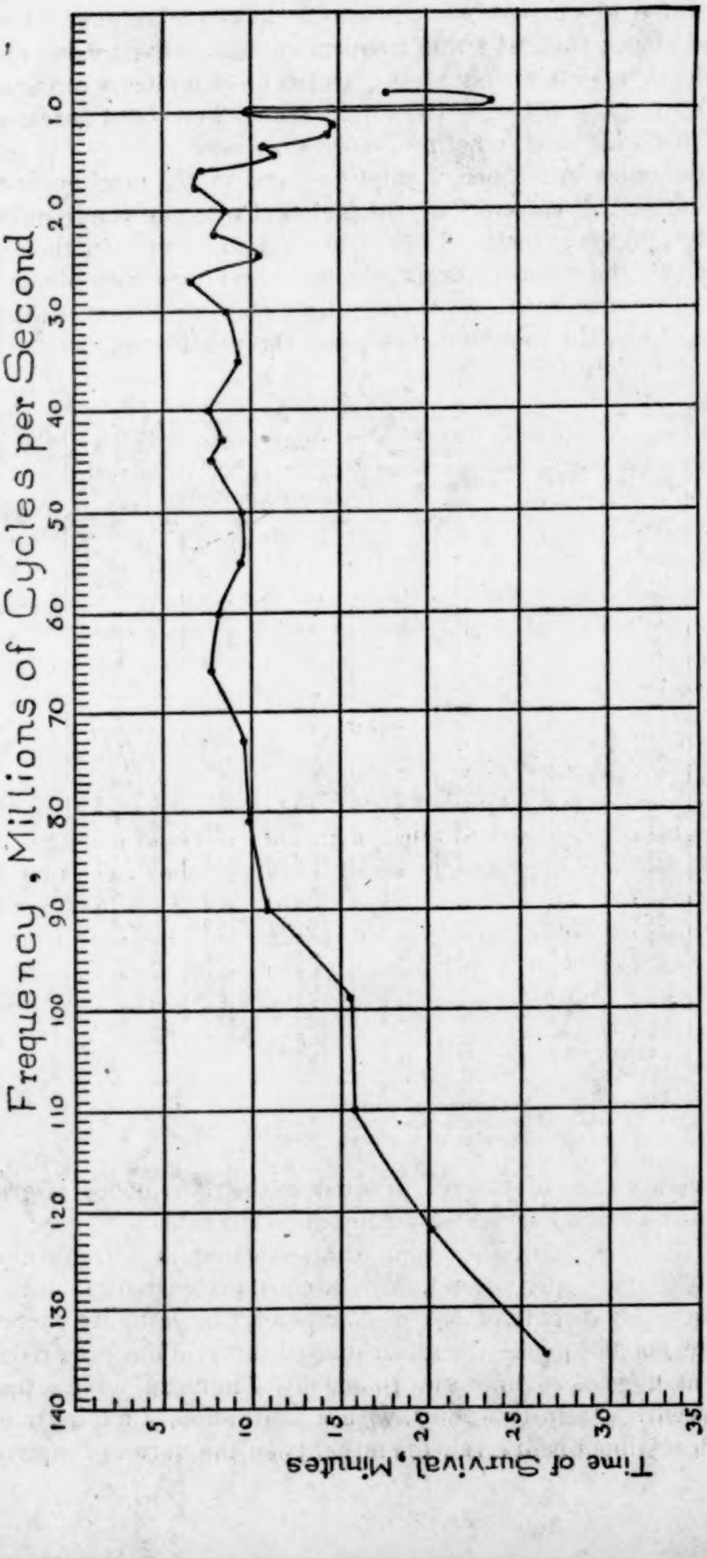


Chart showing the average time of survival of mice subjected to currents of various frequencies

observed maintains itself at more or less the same value over a frequency band of considerable width, i. e. from 66,000,000 to 27, 000,000 cycles, at which point the low average period of survival of 6.65 minutes is recorded, or about 75 per cent less than the average time of survival at 135,000,000 cycles. At 24.3 million cycles the current becomes less lethal by about 40 per cent but at 18,000,000 cycles the current has about the same degree of lethality as at 27,000,000 cycles.

From 18,000,000 cycles the lethality on the whole diminishes, till at 11.1 million cycles the average time of survival increases to 14.5 minutes, 105 per cent longer than at 18,000,000 cycles. At a frequency of 10,000,000 cycles a recrudescence in lethality is observed, the mean time of survival falling to 9.65 minutes. At a frequency of 9,000,000 cycles, however, the lethality is comparatively low, the average time of survival being 23.5 minutes, nearly the same as it was at 135,000,000 cycles. At this frequency three mice survived exposures lasting 30 to 35 minutes apparently unharmed except for slight elevations of the body temperature. At 8.33 million cycles, beyond which point the observations were not carried, the lethality of the exposure seems on the increase, as well as at 8.5 million cycles, as the average time of survival of 11 mice was 17.2 and 17.7 minutes, respectively.

Discussion

From the configuration of the curve it is evident that the results just described are unexpected. Starting with a low lethal effect at the highest frequencies studied, a gradual increase in lethality is observed, followed by maintenance of fatality of the same order with successive small maxima and minima until at 18,000,000 cycles a peak is reached, followed by an abrupt decline, separated from the low point at 9,000,000 cycles by another maximum.

This result differs from what is usually observed in physical phenomena of this character. On the whole one would expect to find either that the lethality of a constant current was independent of frequency, or if dependent would show some simple relation thereto, e. g., be either inversely or directly proportional. That the lethality should be at first inversely and subsequently directly proportional to frequency is puzzling, and certainly not susceptible of any simple explanation.

At first one is tempted to assume that the results of the observation are apparent only. For instance, it might be urged that the apparent low lethality of the higher frequencies might be due to the "skin" effect of these frequencies upon the thermocouple.

As is well known, the high frequency resistance of conductors increases with the frequency, because, as this becomes greater, the current is confined to a surface pellicle of ever-diminishing thickness.

This so-called "skin effect" would occasion an increase with frequency in the apparent resistance of the thermocouple. Hence there would be a greater heating effect at the very high frequencies, and, as a result, a higher e. m. f. between the hot and cold junctions of the thermocouple, which would be reflected by a higher reading on the microammeter scale than would be justified by the actual oscillatory current flowing in the circuit.

That there may be some such effect at the highest frequencies is not denied; but how explain on these grounds the pronounced recession in lethality at the lower frequencies, where the "skin effect" is admittedly much less. Thus, we note that the lethality at 18.1 million cycles is about the same as at 24.3 million cycles, but very much greater (nearly 240 per cent) than at 9,000,000 cycles. Yet the skin effect, if important, should be more noticeable at 18,000,000 than at 9,000,000 cycles.

In view of the circumstance that, generally speaking, exposure to the oscillating current has very much less heating effect on dead than on living tissues, it may be suggested that, here, we are dealing with some action other than the direct heating effect observed at ordinary frequencies with diathermic apparatus.

In this case the heating effect is proportional to the product of the resistance and the square of the current. Under the conditions of this study it is possible that the heat generated is caused by dielectric loss or hysteresis.

Again there is the possibility that the action is indirect rather than direct, the high-frequency current increasing the basal rate of metabolism, or perhaps causing heat retention through its influence upon thermogenic centers.

That the effects of exposure to the high-frequency current is capable of directly damaging tissue is shown by the sequelae already described, which are observed in mice subjected to a sublethal exposure.

As for the differential action of the different frequencies, which is the most striking of the effects observed, nothing except of a speculative nature can be advanced by way of explanation. For instance, it might be thought possible that at certain frequencies harmonics generated by the oscillator are in resonance with the natural period of organic molecules, particularly of animal proteids. These are well known to possess a very high molecular weight except for certain colloidal aggregates, perhaps the highest known molecular weights. Consequently, the natural period of resonance would be correspondingly low.

Nevertheless, in spite of the great size of the body molecules, the natural period of these, though relatively low compared with the molecules of simpler structure, would be sufficiently high to correspond to a wave length of from 0.5 to 3 or 4 millimeters, and hence to a fre-

quency of six times 10^{10} to seven times 10^{9}. The generation of definite harmonics of such a high order on the part of the oscillator seems altogether unlikely.

I am, however, indebted to Prof. George W. Pierce for the suggestion that the differential effects due to frequency may be caused by a mode of electromechanical vibration of the tissue cells, and for the accompanying reference to literature on the subject. Mechanical oscillations in solid elastic spheres have been given thorough mathematical treatment by Lamb.[4] A number of modes of vibration are analyzed and certain constants corresponding therewith are given. Some of the values of these constants (here designated "K") as given by Lamb, are: $K=0.66$, 1.89, 2.93, 3.94, 4.96, 5.97, etc., the lowest value corresponding to the mode of vibration having the longest period. Since a solid elastic sphere is capable of vibrating in a number of different successive modes, each of which has a frequency greater than that preceding it, such a sphere is capable of responding to impressed oscillations of different frequencies.

The frequency, F, at which the sphere vibrates in a particular mode is given in simplest form by the equation—

$$F=K\frac{V}{D} \tag{1}$$

where F= Frequency of the particular mode of vibration.

K= The corresponding constant given by Lamb.

V= Velocity of the propagation of sound in the material composing the sphere.

D= Diameter of the sphere.

From this equation it follows directly that the diameter of a sphere vibrating in a particular mode at frequency, F, is given by the equation—

$$D=K\frac{V}{F} \tag{2}$$

In this case let us assume that the velocity of the propagation of sound through tissue cells is approximately that of its propagation through water, i. e., 1.45×10^{5} centimeters per second. For the value of K let us take 0.66, which corresponds to the mode of vibration having the longest period and thus to the diameter of the smallest sphere capable of vibrating in some mode at that particular frequency. For F let us assume a value $F=40\times10^{6}$, a frequency somewhere in the middle of the band of lethal frequencies observed. Substituting these values in equation (2) we obtain for D, diameter of the sphere, 0.0024 centimeters or 24 microns. This diameter, while great for body cells, is, nevertheless, encountered in a number

[4] Lamb, H.: On the Vibrations of an Elastic Sphere. Proceedings of the London Mathematical Society Series, 1, 1882, vol. 13, p. 189.

of cells in the nervous system. The diameter of the smallest sphere capable of oscillating at the highest frequencies worked with would be in the neighborhood of 7 microns, while at the lowest lethal frequency (lowest frequency of high lethality 10×10^6), this diameter would be 96 microns. This is greater than the diameter of any body cells except, perhaps, some of the giant pyramidal cells of the nervous system. However, in this instance one might venture the speculation that second or third order harmonics of the oscillator might, at the lower frequencies, possess sufficient energy to induce some form of electromechanical resonance in the body cells, although the fundamental frequency is too low to resonate with any except the sufficiently large body cells just mentioned.

As to the way in which electrical oscillations could induce mechanical vibrations in body cells, speculations are again in order. One possibility, at least, is that cell membranes act as dielectrics at the boundaries of cells. This would cause the contiguous surfaces of cells to act as condensers resulting in stresses of alternating polarity at the impressed frequency. A reinforcement of the effect resulting in mechanical vibrations would reasonably be expected when the frequency of the applied stresses approaches the natural period for mechanical vibrations of the cell. It would not, however, be expected that this frequency is critical, as such a system must, of necessity, be highly damped. So, if responsive, the response would merely be greater for a range of frequencies in the neighborhood of the frequency of mechanical vibrations.

Conclusions

On the basis of the data gathered in the foregoing experiments, the following conclusions are permitted:

1. When small laboratory animals are placed in a box of insulating material and subjected to the action of a high frequency oscillating current in the field of a condenser resonating a tuned circuit, severe symptoms are caused which may result in death if the exposure is prolonged. Part at least, of the symptoms is due to heat retention.

2. This effect is most marked in a certain band of frequencies extending from $F = 66 \times 10^6$ cycles to $F = 18.3 \times 10^6$ cycles, the effect diminishing in one direction from a band extending from $F = 66 \times 10^6$ to $F = 135 \times 10^6$ and in the other from $F = 18.3 \times 10^6$ to $F = 9 \times 10^6$.

3. There is, consequently, at constant current, under the conditions of the experiments, a differential action with respect to frequency, the lethality of a constant current being in one region of the spectrum inversely and in another portion directly proportional to frequency.

4. In the band of frequencies studied, successive maxima and minima with respect to lethality occur which are most pronounced as the lower frequencies are approached.

Finally it may be remarked that here we are dealing with a band in the spectrum of radiant energy which as yet has been little studied in its effects on living cells. Since frequency is the sole differentiating characteristic in the whole band of radiant energy it is perhaps to be expected to find that in electromagnetic waves, frequency is a determining factor in their mode of action upon living organisms. It is thought that this is a field which will well repay further study.

PUBLIC HEALTH ENGINEERING ABSTRACTS

Report on the First Results of Laboratory Work on Malaria in England. S. P. James. Publication by the Health Section of the League of Nations, Geneva, 1926. (Abstract by L. D. Fricks.)

While this is a report of observations made on artificially infected mosquitoes in the laboratory, it contains valuable suggestions to those who are engaged in malaria control. These observations were made in connection with the malarial treatment of general paralysis. Two thousand six hundred and thirty-eight *Anopheles maculipennis* were employed, 532 of which became infected and were used to bite 145 persons, 109 of whom developed malaria. Colonel James observes that it is no easy matter to infect mosquitoes with malaria even under the most favorable laboratory conditions. The conditions most favorable to the development of the *Plasmodia* in the mosquito causes high mortality among the mosquitoes themselves. To produce infective mosquitoes it is necessary that they be kept, after feeding on a malaria carrier, at a temperature of 24° C. in an atmosphere saturated with moisture, and the mosquitoes must be given frequent feedings—daily or every other day. It would seem that the required conditions for producing naturally infected mosquitoes are only rarely met. In addition, very few malaria patients are good infectors of *Anopheles*. The extreme delicacy of these requirements indicate to the author that malaria should be dealt with in the houses of the people rather than in the environment, and that a waste of effort is involved in measures directed toward general mosquito destruction.

(Abstractor's note: LePrince pointed out the importance of destroying engorged *Anopheles* in houses as a malaria-control measure in the Panama Canal Zone many years ago.)

Problems in Malaria Control. W. E. Deeks. Fourteenth Annual Report United Fruit Company, 1925, pp. 170–186. (Abstract by L. D. Fricks.)

Doctor Deeks states that malaria is responsible for 40 per cent of the sickness on the plantations of the United Fruit Company, and it is therefore the most important single factor in lowering the efficiency of labor. A description is given of certain United Fruit Company plantations and the extent of the malaria problem thereon indicated. Among the conditions which influence the incidence of

malaria on these plantations are listed the following: Rainfall; location of camps; screening of quarters; and impaired physical condition frequently due to complicating diseases. Measures of malaria control recommended are: Mosquito control for a radius of two miles around the settlements; careful selection of new camp sites; stabilizing of population; and screening of houses and cure of carriers.

AMERICAN PUBLIC HEALTH ASSOCIATION TO MEET IN BUFFALO, OCTOBER 11-14, 1926

What is new in public health? How are communities, urban and rural, coping with the public health problems that confront administrators, public health officers, nurses, and inspectors? These questions will be answered, and problems that have been the subject of laboratory research will be discussed by specialists at the fifty-fifth annual meeting of the American Public Health Association to be held in Buffalo, N. Y., October 11-14, 1926. This association is the professional society of the public health workers of North America.

It is expected that this year's meeting will be the largest and the most interesting of all the annual gatherings of the association, and this expectation is fully justified on the basis of the announcements contained in the preliminary program recently issued. The sessions are arranged in four sections—general sessions; special sessions, which have been developed around subjects of timely and lively interest; sessions of the nine scientific sections of the association; and the special program arranged by the New York State Conference of Health Officers and Public Health Nurses, which the State health commissioner, Dr. Matthias Nicoll, has called to meet in conjunction with the American Public Health Association.

The meeting will begin on Monday morning, October 11, and will end with a special dinner session on Thursday evening, October 14. The headquarters of the association will be in the Hotel Statler, where all sessions will be held. The preliminary program and other information regarding the meeting may be had by addressing Homer N. Calver, Executive Secretary, American Public Health Association, 370 Seventh Avenue, New York City.

AMERICAN DIETETIC ASSOCIATION MEETING AT ATLANTIC CITY

The American Dietetic Association will hold its ninth annual meeting at Atlantic City, October 11, 12, and 13, 1926. The program will include papers and discussions on both scientific and administrative matters.

Dr. J. J. R. McLeod, of the University of Toronto, will address the convention on the advances made in physiology, and Dr. Julius Stieglitz, of the University of Chicago, will speak on the recent advances made in chemistry.

Arrangements have been made for some interesting exhibits, both commercial and noncommercial.

Dr. Ruth Wheeler, professor of physiology at Vassar, is the president of the association.

DEATHS DURING WEEK ENDED AUGUST 28, 1926

Summary of information received by telegraph from industrial insurance companies for week ended August 28, 1926, and corresponding week of 1925. (From the Weekly Health Index, September 1, 1926, issued by the Bureau of the Census, Department of Commerce)

	Week ended Aug. 28, 1926	Corresponding week, 1925
Policies in force	64, 869, 549	60, 879, 605
Number of death claims	10, 175	10, 590
Death claims per 1,000 policies in force, annual rate	8. 2	9. 1

Deaths from all causes in certain large cities of the United States during the week ended August 28, 1926, infant mortality, annual death rate, and comparison with corresponding week of 1925. (From the Weekly Health Index, September 1, 1926, issued by the Bureau of the Census, Department of Commerce)

City	Week ended Aug. 28, 1926		Annual death rate per 1,000 corresponding week, 1925	Deaths under 1 year		Infant mortality rate, week ended Aug. 28, 1926[2]
	Total deaths	Death rate[1]		Week ended Aug. 28, 1926	Corresponding week, 1925	
Total (65 cities)	5, 625	10. 2	10. 5	760	901	[3] 61
Akron	27		13. 3	8	11	85
Albany[4]	19	8. 3		1	0	21
Atlanta	63			13	7	
White	26			4		
Colored	37	(5)		9		
Baltimore[4]	167	10. 8	10. 7	25	22	73
White	125			17		61
Colored	42	(5)		8		130
Birmingham	56	13. 8	14. 7	13	6	
White	34			7		
Colored	22	(5)		6		
Boston	186	12. 3	11. 5	45	23	127
Bridgeport	28			3	2	51
Buffalo	119	11. 4	10. 7	8	24	33
Cambridge	18	7. 7	7. 8	3	3	50
Camden	23	9. 2	8. 1	7	4	118
Canton	21	10. 0	3. 9	4	0	89
Chicago[4]	533	9. 1	9. 3	61	81	54
Cincinnati	129	16. 4	14. 0	15	14	93
Cleveland	166	9. 0	9. 6	21	36	54
Columbus	64	11. 7	11. 9	10	12	92
Dallas	39	10. 2	10. 5	8	7	
White	28			8		
Colored	11	(5)		0		
Dayton	38	11. 2	9. 6	0	2	0
Denver	62	11. 3	16. 0	8	16	
Des Moines	16	5. 7	8. 5	2	3	33
Detroit	212	8. 6	10. 4	39	66	63
Duluth	21	9. 7	9. 0	2	3	47
El Paso	23	11. 0	11. 9	3	5	
Erie	21			2	1	38
Fall River[4]	24	9. 6	9. 7	2	5	29
Flint	17	6. 5	7. 2	5	5	83
Fort Worth	25	8. 2	6. 2	5	1	
White	22			5		
Colored	3	(5)		0		
Grand Rapids	19	6. 4	11. 2	0	10	0
Houston	37			4	4	
White	28			2		
Colored	9	(5)		2		
Indianapolis	92	13. 1	12. 1	12	10	88
White	73			8		68
Colored	19	(5)		4		220

See footnotes at end of table.

Deaths from all causes in certain large cities of the United States during the week ended August 28, 1926, infant mortality, annual death rate, and comparison with corresponding week of 1925—Continued

City	Week ended Aug. 28, 1926		Annual death rate per 1,000 corresponding week, 1925	Deaths under 1 year		Infant mortality rate, week ended Aug. 28, 1926[2]
	Total deaths	Death rate[1]		Week ended Aug. 28, 1926	Corresponding week, 1925	
Jersey City	40	6.6	10.4	4	8	28
Kansas City, Kans	21	9.4	12.1	0	2	0
White	17	-----	-----	0	-----	0
Colored	4	([5])	-----	0	-----	0
Kansas City, Mo	85	11.8	11.4	13	11	-----
Los Angeles	203	-----	-----	15	22	42
Louisville	74	12.4	10.7	9	8	78
White	54	-----	-----	7	-----	70
Colored	20	([5])	-----	2	-----	125
Lowell	18	-----	-----	2	6	37
Lynn	15	7.5	6.1	2	3	50
Memphis	61	18.0	16.7	9	9	-----
White	29	-----	-----	5	-----	-----
Colored	32	([5])	-----	4	-----	-----
Milwaukee	74	7.5	8.8	16	7	74
Minneapolis	92	11.1	9.7	9	9	50
Nashville[4]	55	20.9	14.9	8	3	-----
New Bedford	31	-----	-----	5	5	87
New Haven	53	15.2	11.4	5	8	68
New Orleans	147	18.3	16.6	17	21	-----
White	76	-----	-----	5	-----	-----
Colored	71	([5])	-----	12	-----	-----
New York	1,036	9.1	9.7	126	154	51
Bronx Borough	123	7.1	6.9	10	8	33
Brooklyn Borough	341	7.9	8.6	54	57	55
Manhattan Borough	425	11.8	12.9	45	73	50
Queens Borough	103	7.0	7.2	16	15	73
Richmond Borough	44	16.0	10.9	1	1	18
Newark, N. J	101	11.5	10.7	25	15	120
Norfolk	32	9.6	8.0	2	3	37
White	8	-----	-----	0	-----	0
Colored	24	([5])	-----	2	-----	99
Oakland	43	8.6	8.8	7	6	81
Oklahoma City	18	-----	-----	3	0	-----
Omaha	53	12.8	13.1	6	5	63
Paterson	18	6.6	12.1	3	2	52
Philadelphia	354	9.2	10.6	40	77	53
Pittsburgh	147	12.0	13.3	23	33	76
Portland, Oreg	52	-----	-----	2	3	20
Providence	53	10.0	8.8	7	8	58
Richmond	43	11.9	11.5	12	7	151
White	24	-----	-----	4	-----	78
Colored	19	([5])	-----	8	-----	280
Rochester	64	10.4	11.9	5	12	40
St. Louis	158	9.9	10.7	21	27	-----
St. Paul	41	8.6	12.3	1	3	9
Salt Lake City[4]	29	11.4	8.8	0	0	0
San Antonio	45	11.4	12.4	6	7	-----
San Diego	29	13.7	10.3	1	1	21
San Francisco	116	10.7	11.0	8	11	48
Schenectady	24	13.5	12.4	6	8	173
Seattle	61	-----	-----	4	5	37
Somerville	19	9.9	8.4	6	2	156
Spokane	17	8.1	10.5	4	1	94
Springfield, Mass	28	10.1	9.2	3	2	43
Syracuse	43	12.2	10.3	3	7	38
Toledo	52	9.2	10.5	7	8	68
Trenton	31	12.1	15.0	4	8	67
Utica	25	12.7	10.3	2	3	44
Washington, D. C	109	10.8	12.3	15	22	85
White	72	-----	-----	7	-----	58
Colored	37	([5])	-----	8	-----	146
Waterbury	23	-----	-----	5	4	107
Wilmington, Del	18	7.6	8.5	4	5	94
Worcester	37	10.0	12.6	9	7	104
Yonkers	15	6.7	11.5	2	5	45
Youngstown	39	12.3	7.8	11	5	140

[1] Annual rate per 1,000 population.
[2] Deaths under 1 year per 1,000 births. Cities left blank are not in the registration area for births.
[3] Data for 63 cities.
[4] Deaths for week ended Friday, Aug. 27, 1926.
[5] In the cities for which deaths are shown by color, the colored population in 1920 constituted the following percentages of the total population: Atlanta 31, Baltimore 15, Birmingham 39, Dallas 15, Fort Worth 14, Houston 25, Indianapolis 11, Kansas City, Kans., 14, Louisville 17, Memphis 38, New Orleans 26, Norfolk 38, Richmond 32, and Washington, D. C., 25.

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers

Reports for Week Ended September 4, 1926

ALABAMA

	Cases
Cerebrospinal meningitis	1
Chicken pox	4
Diphtheria	18
Influenza	8
Malaria	112
Measles	20
Mumps	7
Ophthalmia neonatorum	1
Pellagra	11
Pneumonia	25
Scarlet fever	12
Smallpox	7
Tuberculosis	56
Typhoid fever	103
Whooping cough	17

ARIZONA

	Cases
Diphtheria	7
Malaria	1
Measles	2
Tuberculosis	16
Typhoid fever	1

ARKANSAS

	Cases
Chicken pox	12
Diphtheria	3
Hookworm disease	2
Influenza	13
Malaria	198
Measles	3
Mumps	8
Paratyphoid fever	2
Pellagra	11
Poliomyelitis	1
Scarlet fever	1
Smallpox	5
Trachoma	2
Tuberculosis	15
Typhoid fever	92
Whooping cough	19

CALIFORNIA

	Cases
Cerebrospinal meningitis:	
Long Beach	1
San Diego County	1
Chicken pox	29
Diphtheria	87
Influenza	6
Measles	141
Mumps	60
Poliomyelitis:	
Long Beach	1
Paso Robles	1
Redwood City	1
San Diego	1
Rabies (human)—Los Angeles County	1
Scarlet fever	63
Smallpox	7
Tuberculosis	163
Typhoid fever	20
Whooping cough	40

COLORADO

	Cases
Chicken pox	10
Diphtheria	13
Influenza	4
Mumps	2
Pneumonia	1
Scarlet fever	4
Tuberculosis	54
Typhoid fever	15
Vincent's angina	2
Whooping cough	27

CONNECTICUT

	Cases
Cerebrospinal meningitis	1
Chicken pox	2
Diphtheria	9
German measles	1
Influenza	1
Malaria	1

CONNECTICUT—continued

	Cases
Measles	9
Mumps	1
Paratyphoid fever	1
Pneumonia (broncho)	7
Pneumonia (lobar)	6
Poliomyelitis	1
Scarlet fever	13
Septic sore throat	18
Tuberculosis (all forms)	35
Typhoid fever	8
Whooping cough	36

DELAWARE

Diphtheria	1
Malaria	1
Poliomyelitis	1
Scarlet fever	4
Tuberculosis	2
Typhoid fever	2

FLORIDA

Diphtheria	10
Influenza	2
Malaria	6
Measles	5
Mumps	6
Scarlet fever	4
Smallpox	10
Tetanus	1
Tuberculosis	8
Typhoid fever	7
Typhus fever	1
Whooping cough	8

GEORGIA

Dengue	1
Diphtheria	12
Dysentery	9
Hookworm disease	4
Influenza	15
Malaria	46
Measles	4
Mumps	2
Paratyphoid fever	5
Pellagra	1
Pneumonia	5
Poliomyelitis	1
Rabies	1
Scarlet fever	3
Septic sore throat	20
Smallpox	5
Tuberculosis	4
Typhoid fever	68
Whooping cough	22

IDAHO

Chicken pox	1
Measles	1
Mumps	1
Scarlet fever	5
Smallpox	2
Typhoid fever	1
Whooping cough	10

ILLINOIS

Cerebrospinal meningitis:	
Cook County	2
Moultrie County	1
Peoria County	1

ILLINOIS—continued

	Cases
Chicken pox	17
Diphtheria	69
Influenza	37
Lethargic encephalitis:	
Cook County	1
Henry County	1
Jackson County	1
Lawrence County	1
Lee County	1
Perry County	1
Schuyler County	1
Stephenson County	1
Measles	50
Mumps	23
Pneumopia	156
Poliomyelitis:	
Iroquois County	1
McLean County	1
Peoria County	1
Tazewell County	2
Scarlet fever	59
Smallpox	3
Tuberculosis	425
Typhoid fever	41
Whooping cough	185

INDIANA

Cerebrospinal meningitis	1
Chicken pox	1
Diphtheria	15
Influenza	9
Measles	13
Scarlet fever	15
Smallpox	3
Tuberculosis	50
Typhoid fever	21
Whooping cough	15

IOWA

Chicken pox	3
Diphtheria	12
Measles	1
Mumps	2
Pneumonia	1
Scarlet fever	8
Smallpox	2
Tuberculosis	4
Typhoid fever	6
Whooping cough	6

KANSAS

Cerebrospinal meningitis—Mayetta	1
Chicken pox	2
Diphtheria	10
Influenza	4
Malaria	7
Measles	5
Pneumonia	17
Poliomyelitis:	
Hutchinson	3
Jennings	1
Norcatur	1
Spearville	1
Stafford	1
Scarlet fever	29
Smallpox	2

KANSAS—continued

	Cases
Tetanus	1
Tuberculosis	50
Typhoid fever	22
Whooping cough	38

LOUISIANA

Diphtheria	14
Influenza	7
Lethargic encephalitis	1
Malaria	16
Pneumonia	20
Poliomyelitis	1
Scarlet fever	7
Smallpox	5
Tuberculosis	35
Typhoid fever	29

MAINE

Chicken pox	9
Diphtheria	1
Influenza	6
Measles	26
Pneumonia	2
Scarlet fever	20
Tuberculosis	5
Typhoid fever	14
Vincent's angina	2
Whooping cough	11

MARYLAND [1]

Cerebrospinal meningitis	3
Chicken pox	4
Diphtheria	18
Dysentery	16
Influenza	3
Lethargic encephalitis	5
Malaria	1
Measles	7
Mumps	3
Paratyphoid fever	3
Pneumonia (broncho)	7
Pneumonia (lobar)	11
Poliomyelitis	5
Scarlet fever	9
Tetanus	1
Trachoma	1
Tuberculosis	42
Typhoid fever	72
Whooping cough	72

MASSACHUSETTS

Cerebrospinal meningitis	1
Chicken pox	10
Conjunctivitis (suppurative)	6
Diphtheria	46
Dysentery	1
German measles	4
Lethargic encephalitis	1
Measles	17
Mumps	24
Ophthalmia neonatorum	34
Pellagra	1
Pneumonia (lobar)	16
Poliomyelitis	10
Scarlet fever	54
Septic sore throat	2

[1] Week ended Friday.

7237°—26†——3

MASSACHUSETTS—continued

	Cases
Trachoma	1
Trichinosis	1
Tuberculosis (pulmonary)	104
Tuberculosis (other forms)	35
Typhoid fever	14
Whooping cough	81

MICHIGAN

Diphtheria	85
Measles	26
Pneumonia	68
Scarlet fever	72
Smallpox	1
Tuberculosis	249
Typhoid fever	18
Whooping cough	174

MINNESOTA

Chicken pox	7
Diphtheria	28
Influenza	1
Lethargic encephalitis	2
Measles	20
Poliomyelitis	3
Scarlet fever	59
Smallpox	3
Trachoma	1
Tuberculosis	33
Typhoid fever	7
Whooping cough	27

MISSISSIPPI

Diphtheria	22
Poliomyelitis	1
Scarlet fever	6
Smallpox	2
Typhoid fever	51

MISSOURI

(Exclusive of Kansas City)

Chicken pox	2
Diphtheria	15
Malaria	1
Measles	7
Mumps	11
Poliomyelitis	1
Scarlet fever	37
Smallpox	1
Trachoma	5
Tuberculosis	32
Typhoid fever	39
Whooping cough	27

MONTANA

Chicken pox	1
Diphtheria	2
Measles	5
Mumps	1
Rocky Mountain spotted fever	3
Scarlet fever	13
Smallpox	3
Tetanus	1
Tuberculosis	2
Typhoid fever	4

NEBRASKA

	Cases
Diphtheria	1
Measles	3
Poliomyelitis	1
Scarlet fever	2
Septic sore throat	2
Smallpox	2
Tuberculosis	1
Typhoid fever	4
Whooping cough	41

NEW JERSEY

Chicken pox	8
Diphtheria	33
Dysentery	1
Influenza	7
Measles	15
Paratyphoid fever	1
Pneumonia	18
Poliomyelitis	1
Scarlet fever	15
Typhoid fever	24
Whooping cough	134

NEW MEXICO

Chicken pox	2
Diphtheria	1
Measles	2
Mumps	4
Pneumonia	1
Rabies (in animals)	3
Tuberculosis	21
Typhoid fever	6
Whooping cough	6

NEW YORK

(Exclusive of New York City)

Cerebrospinal meningitis	1
Chicken pox	30
Diphtheria	34
German measles	8
Malaria	12
Measles	76
Mumps	18
Ophthalmia neonatorum	1
Paratyphoid fever	1
Pneumonia	38
Poliomyelitis	52
Scarlet fever	37
Tetanus	1
Typhoid fever	22
Vincent's angina	6
Whooping cough	104

NORTH CAROLINA

Chicken pox	4
Diphtheria	56
Dysentery (bacillary)	7
German measles	2
Malaria	23
Measles	24
Ophthalmia neonatorum	1
Poliomyelitis	12
Scarlet fever	35
Septic sore throat	4
Smallpox	17
Typhoid fever	107
Whooping cough	221

[1] Deaths.

OKLAHOMA

(Exclusive of Oklahoma City and Tulsa)

	Cases
Diphtheria	10
Influenza	18
Malaria	120
Measles	6
Pellagra	12
Pneumonia	7
Poliomyelitis—Hughes County	1
Scarlet fever	4
Typhoid fever	94
Whooping cough	14

OREGON

Chicken pox	3
Diphtheria	10
Dysentery	1
Influenza	14
Measles	6
Mumps	3
Pneumonia	[1] 5
Poliomyelitis	1
Scarlet fever	8
Septic sore throat	1
Smallpox	9
Tuberculosis	10
Typhoid fever	6
Whooping cough	12

PENNSYLVANIA

Chicken pox	53
Diphtheria	117
German measles	12
Impetigo contagiosa	20
Measles	123
Mumps	8
Ophthalmia neonatorum—Philadelphia	8
Pneumonia	10
Poliomyelitis:	
Brothers Valley Township [2]	1
Chambersburg	1
Johnstown	2
Philadelphia	2
Scarlet fever	127
Tetanus:	
Franklin	1
North Whitehall Township [2]	1
St. Clair	1
Trachoma—Philadelphia	1
Tuberculosis	100
Typhoid fever	84
Whooping cough	389

RHODE ISLAND

Diphtheria	1
German measles	1
Influenza	4
Measles	1
Pneumonia	1
Poliomyelitis—Newport	1
Scarlet fever	3
Tuberculosis	10
Typhoid fever	1
Whooping cough	13

[2] County not specified

SOUTH DAKOTA

	Cases
Diphtheria	1
Measles	2
Pneumonia	1
Scarlet fever	11
Smallpox	3
Tuberculosis	2
Typhoid fever	5
Whooping cough	4

TENNESSEE

	Cases
Chicken pox	4
Diphtheria	17
Dysentery	2
Influenza	4
Malaria	47
Measles	6
Pellagra	5
Pneumonia	3
Poliomyelitis:	
Davidson County	1
Franklin County	1
Overton County	1
Scarlet fever	17
Smallpox	1
Tuberculosis	28
Typhoid fever	206
Whooping cough	18

TEXAS

	Cases
Chicken pox	5
Diphtheria	13
Influenza	18
Measles	3
Mumps	1
Paratyphoid fever	2
Pellagra	1
Pneumonia	2
Poliomyelitis	1
Scarlet fever	11
Smallpox	2
Tuberculosis	33
Typhoid fever	20
Whooping cough	30

UTAH

	Cases
Chicken pox	3
Diphtheria	13
Measles	3
Pneumonia	4
Poliomyelitis—Salt Lake City	1
Scarlet fever	2
Typhoid fever	1
Whooping cough	27

VERMONT

	Cases
Chicken pox	3
Diphtheria	3
Measles	3
Mumps	1
Whooping cough	19

WASHINGTON

	Cases
Cerebrospinal meningitis	1
Chicken pox	10
Diphtheria	8
German measles	4
Measles	6
Mumps	1
Pneumonia	1
Scarlet fever	14
Smallpox	6
Tuberculosis	17
Typhoid fever	25
Whooping cough	19

WEST VIRGINIA

	Cases
Chicken pox	1
Diphtheria	16
Influenza	20
Measles	22
Scarlet fever	20
Smallpox	3
Tuberculosis	8
Typhoid fever	24
Whooping cough	39

WISCONSIN

	Cases
Milwaukee:	
Chicken pox	1
Diphtheria	5
German measles	1
Measles	8
Mumps	2
Pneumonia	2
Poliomyelitis	1
Scarlet fever	8
Tuberculosis	8
Typhoid fever	1
Whooping cough	66
Scattering:	
Chicken pox	13
Diphtheria	13
German measles	4
Influenza	2
Measles	91
Mumps	6
Pneumonia	3
Poliomyelitis	1
Scarlet fever	38
Smallpox	6
Tuberculosis	37
Typhoid fever	11
Whooping cough	123

WYOMING

	Cases
Cerebrospinal meningitis—Natrona County	1
Chicken pox	1
Scarlet fever	2
Smallpox	1
Typhoid fever	1
Whooping cough	2

Reports for Week Ended August 28, 1926

CALIFORNIA

	Cases
Cerebrospinal meningitis—San Bernardino County	1
Chicken pox	33
Diphtheria	75
Influenza	6
Lethargic encephalitis:	
Los Angeles County	1
Santa Ana	1
Measles	141
Mumps	73
Poliomyelitis:	
Los Angeles	1
Los Angeles County	1
California [1]	1
Scarlet fever	65
Smallpox	4
Tuberculosis	171
Typhoid fever	23
Whooping cough	54

DISTRICT OF COLUMBIA

	Cases
Chicken pox	1
Diphtheria	7
Influenza	1
Pneumonia	2
Poliomyelitis	1
Scarlet fever	14
Tuberculosis	14

[1] Place not specified.

DISTRICT OF COLUMBIA—continued

	Cases
Typhoid fever	3
Whooping cough	13

NORTH DAKOTA

	Cases
Chicken pox	2
Diphtheria	1
German measles	3
Pneumonia	3
Scarlet fever	8
Tuberculosis	3
Typhoid fever	2
Whooping cough	29

SOUTH CAROLINA

	Cases
Chicken pox	3
Dengue	32
Diphtheria	28
Hookworm disease	28
Influenza	78
Malaria	382
Paratyphoid fever	21
Pellagra	64
Poliomyelitis	2
Scarlet fever	9
Smallpox	8
Tuberculosis	48
Typhoid fever	118
Whooping cough	34

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of monthly State reports is published weekly and covers only those States from which reports are received during the current week:

State	Cerebrospinal meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
July, 1926										
Florida	3	66	301	33	55	7	3	14	48	64
Georgia	2	26	66	216	124	56	1	13	29	414
Iowa	2	37			72		0	76	59	10
Louisiana	0	25	166	126	1	37	2	24	5	188
Maryland		45	9	4	360	1	11	97	0	68
Virginia	5	64	280	175	638	21	22	68	44	188
Washington	12	128	8		183		3	118	85	36

GENERAL CURRENT SUMMARY AND WEEKLY REPORTS FROM CITIES

Diphtheria.—For the week ended August 21, 1926, 37 States reported 655 cases of diphtheria. For the week ended August 22, 1925, the same States reported 879 cases of this disease. Ninety-eight cities, situated in all parts of the country and having an aggregate population of more than 30,200,000, reported 397 cases of diphtheria for the week ended August 21, 1926. Last year for the corresponding week they reported 388 cases. The estimated expectancy for these cities was 541 cases. The estimated expectancy is based on the experience of the last nine years, excluding epidemics.

Measles.—Thirty-five States reported 975 cases of measles for the week ended August 21, 1926, and 401 cases of this disease for the week ended August 22, 1925. Ninety-eight cities reported 238 cases of measles for the week this year, and 170 cases last year.

Poliomyelitis.—The health officers of 37 States reported 99 cases of poliomyelitis for the week ended August 21, 1926. The same States reported 296 cases for the week ended August 22, 1925.

Scarlet fever.—Scarlet fever was reported for the week as follows: Thirty-seven States—this year, 858 cases; last year, 705 cases; 98 cities—this year, 281 cases; last year, 285 cases; estimated expectancy, 238 cases.

Smallpox.—For the week ended August 21, 1926, 37 States reported 129 cases of smallpox. Last year for the corresponding week they reported 135 cases. Ninety-eight cities reported smallpox for the week as follows: 1926, 12 cases; 1925, 29 cases; estimated expectancy, 23 cases. No deaths from smallpox were reported by these cities for the week this year.

Typhoid fever.—One thousand two hundred and fifty-one cases of typhoid fever were reported for the week ended August 21, 1926, by 36 States. For the corresponding week of 1925, the same States reported 1,319 cases of this disease. Ninety-eight cities reported 237 cases of typhoid fever for the week this year and 314 cases for the corresponding week last year. The estimated expectancy for these cities was 235 cases.

Influenza and pneumonia.—Deaths from influenza and pneumonia were reported for the week by 94 cities, with a population of nearly 29,700,000, as follows: 1926, 324 deaths; 1925, 309 deaths.

City reports for week ended August 21, 1926

The "estimated expectancy" given for diphtheria, poliomyelitis, scarlet fever, smallpox, and typhoid fever is the result of an attempt to ascertain from previous occurrence how many cases of the disease under consideration may be expected to occur during a certain week in the absence of epidemics. It is based on reports to the Public Health Service during the past nine years. It is in most instances the median number of cases reported in the corresponding week of the preceding years. When the reports include several epidemics or when for other reasons the median is unsatisfactory, the epidemic periods are excluded and the estimated expectancy is the mean number of cases reported for the week during nonepidemic years.

If reports have not been received for the full nine years, data are used for as many years as possible, but no year earlier than 1917 is included. In obtaining the estimated expectancy the figures are smoothed when necessary to avoid abrupt deviations from the usual trend. For some of the diseases given in the table the available data were not sufficient to make it practicable to compute the estimated expectancy.

Division, State, and city	Population July 1, 1925, estimated	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
			Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
NEW ENGLAND									
Maine:									
Portland	75,333	0	1	0	0	0	1	1	4
New Hampshire:									
Concord	22,546	0	0	0	0	0	0	0	0
Manchester	83,097	0	0	0	0	0	0	0	1
Vermont:									
Barre	10,008	0	0	0	0	0	0	0	0
Massachusetts:									
Boston	779,620	11	31	6	1	0	15	14	9
Fall River	128,993	2	2	3	0	0	0	0	0
Springfield	142,065	0	2	0	0	0	0	0	0
Worcester	190,757	0	2	4	0	0	0	0	0
Rhode Island:									
Pawtucket	69,760	0	0	0	0	0	0	0	0
Providence	267,918	0	3	2	0	0	0	0	1
Connecticut:									
Bridgeport	([1])	0	4	3	0	0	0	0	0
Hartford	160,197	1	3	1	0	0	2	0	3
New Haven	178,927	0	2	1	0	0	4	0	0
MIDDLE ATLANTIC									
New York:									
Buffalo	538,016	0	11	10	-------	0	1	3	5
New York	5,873,356	35	107	69	6	1	14	14	80
Rochester	316,786	2	4	2	-------	0	1	2	2
Syracuse	182,003	0	3	1	-------	0	10	0	0
New Jersey:									
Camden	128,642	0	2	7	0	0	2	0	1
Newark	452,513	4	7	2	2	0	8	2	4
Trenton	132,020	0	2	1	0	0	0	0	0
Pennsylvania:									
Philadelphia	1,979,364	12	33	23	-------	0	7	0	15
Pittsburgh	631,563	2	15	4	-------	2	11	0	10
Reading	112,707	3	2	0	-------	0	1	0	0
EAST NORTH CENTRAL									
Ohio:									
Cincinnati	409,333	0	6	3	0	1	3	1	6
Cleveland	936,485	10	19	35	0	1	5	1	6
Columbus	279,836	0	2	4	0	0	2	0	1
Toledo	287,380	1	5	1	0	1	2	0	4
Indiana:									
Fort Wayne	97,846	0	1	0	0	0	0	0	2
Indianapolis	358,819	0	5	1	0	0	0	0	8
South Bend	80,091	0	0	2	0	0	3	0	1
Terre Haute	71,071	0	1	0	0	1	0	0	0
Illinois:									
Chicago	2,995,239	22	50	28	2	2	42	5	15
Peoria	81,564	0	1	1	0	0	1	0	1
Springfield	63,923	1	1	0	0	0	0	0	0
Michigan:									
Detroit	1,245,824	8	25	45	0	0	10	2	5
Flint	130,316	0	4	1	0	0	0	0	1
Grand Rapids	153,698	0	2	0	0	0	2	0	1

[1] No estimate made.

City reports for week ended August 21, 1926—Continued

Division, State, and city	Population July 1, 1925, estimated	Chicken pox, cases reported	Diphtheria: Cases, estimated expectancy	Diphtheria: Cases reported	Influenza: Cases reported	Influenza: Deaths reported	Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
EAST NORTH CENTRAL—continued									
Wisconsin:									
Kenosha	50,891	0	1	0	0	0	17	0	1
Madison	46,385	-	1	-	-	-	-	-	-
Milwaukee	509,192	4	10	4	0	0	17	5	3
Racine	67,707	2	1	0	0	0	4	0	1
Superior	39,671	0	0	4	0	0	0	0	0
WEST NORTH CENTRAL									
Minnesota:									
Duluth	110,502	0	2	0	0	0	3	0	3
Minneapolis	425,435	3	12	15	0	0	0	0	4
St. Paul	246,001	0	11	6	0	1	1	0	8
Iowa:									
Davenport	52,469	0	1	0	0	-	0	0	-
Sioux City	76,411	0	1	0	0	-	0	0	-
Waterloo	36,771	0	0	0	0	-	2	0	-
Missouri:									
Kansas City	367,481	0	3	0	0	0	4	0	4
St. Joseph	78,342	0	0	0	0	0	1	0	2
St. Louis	821,543	3	18	20	0	0	0	0	-
North Dakota:									
Fargo	26,403	0	1	0	0	0	0	0	0
Grand Forks	14,811	0	0	0	0	-	0	0	-
South Dakota:									
Aberdeen	15,036	0	0	0	0	-	0	0	-
Sioux Falls	30,127	-	0	-	-	-	-	-	-
Nebraska:									
Lincoln	60,941	0	1	0	0	0	0	1	0
Omaha	211,768	0	5	0	0	0	1	0	1
Kansas:									
Topeka	55,411	0	1	0	0	0	1	0	1
Wichita	88,367	0	1	0	0	0	1	0	0
SOUTH ATLANTIC									
Delaware:									
Wilmington	122,049	0	1	0	0	0	0	1	0
Maryland:									
Baltimore	796,296	4	12	8	2	0	0	3	18
Cumberland	33,741	0	0	0	0	0	0	0	0
Frederick	12,035	0	0	0	0	0	0	0	0
District of Columbia:									
Washington	497,906	0	3	7	0	0	3	0	8
Virginia:									
Lynchburg	30,395	0	1	1	0	0	0	0	1
Norfolk	[1]	0	1	0	0	0	0	0	2
Richmond	186,403	0	5	12	0	0	7	0	2
Roanoke	58,208	0	2	0	0	0	0	0	0
West Virginia:									
Charleston	49,019	0	1	0	0	1	0	0	0
Huntington	63,485	0	0	0	0	0	0	0	1
Wheeling	56,208	0	0	0	0	0	1	0	1
North Carolina:									
Raleigh	30,371	0	0	0	0	0	1	0	2
Wilmington	37,061	0	0	0	0	0	0	0	1
Winston-Salem	69,031	0	1	0	0	0	1	0	3
South Carolina:									
Charleston	73,125	0	1	1	0	0	0	0	0
Columbia	41,225	0	1	1	0	0	0	0	0
Greenville	27,311	0	1	0	0	0	0	0	0
Georgia:									
Atlanta	[1]	1	2	1	2	0	0	0	3
Brunswick	16,809	0	0	0	2	0	0	0	2
Savannah	93,134	0	0	0	0	0	0	0	0
Florida:									
Miami	69,754	0	-	1	0	0	1	0	2
St. Petersburg	26,847	-	0	-	-	0	-	-	0
Tampa	94,743	0	1	1	0	0	6	0	3

[1] No estimate made.

City reports for week ended August 21, 192 —Continued

Division, State, and city	Population July 1, 1925, estimated	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
			Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
EAST SOUTH CENTRAL									
Kentucky:									
Covington	58,309	0	0	0	0	0	0	0	0
Louisville	305,935	0	3	0	0	0	1	0	3
Tennessee:									
Memphis	174,533	0	3	0	0	0	0	0	0
Nashville	136,220	0	1	3	0	0	0	0	2
Alabama:									
Birmingham	205,670	1	2	1	5	0	6	1	1
Mobile	65,955	0	0	0	0	0	0	0	1
Montgomery	46,481	0	1	0	0	0	0	0	0
WEST SOUTH CENTRAL									
Arkansas:									
Fort Smith	31,643	------	1	------	------	------	------	------	------
Little Rock	74,216	0	1	1	0	0	0	0	2
Louisiana:									
New Orleans	414,493	0	6	11	4	5	1	0	2
Shreveport	57,857	0	0	1	0	0	0	0	1
Oklahoma:									
Oklahoma City	(1)	0	1	0	0	0	0	0	3
Texas:									
Dallas	194,450	0	3	1	0	0	1	1	4
Galveston	48,375	0	1	0	0	0	0	0	0
Houston	164,954	0	1	0	0	0	0	0	1
San Antonio	198,069	0	1	1	0	1	0	0	5
MOUNTAIN									
Montana:									
Billings	17,971	0	0	0	0	0	0	0	1
Great Falls	29,883	0	1	0	0	0	0	0	0
Helena	12,037	0	0	0	0	0	0	0	0
Missoula	12,668	0	0	0	0	0	0	0	0
Idaho:									
Boise	23,042	0	0	1	0	0	0	0	0
Colorado:									
Denver	280,911	3	8	11	------	0	1	1	4
Pueblo	43,787	0	3	1	0	0	0	0	0
New Mexico:									
Albuquerque	21,000	0	0	0	0	0	0	1	0
Arizona:									
Phoenix	38,669	0	0	1	0	0	0	0	1
Utah:									
Salt Lake City	130,948	1	2	3	0	0	1	0	4
Nevada:									
Reno	12,665	0	0	0	0	0	0	0	0
PACIFIC									
Washington:									
Seattle	(1)	11	3	1	0	------	4	4	------
Spokane	108,897	1	2	2	0	------	10	0	------
Tacoma	104,455	0	1	2	0	1	0	0	1
Oregon:									
Portland	282,383	0	4	6	0	0	8	2	4
California:									
Los Angeles	(1)	11	24	12	3	0	1	2	12
Sacramento	72,260	1	2	0	0	0	1	1	0
San Francisco	557,530	6	13	6	1	1	13	0	9

[1] No estimate made.

City reports for week ended August 21, 1926—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
NEW ENGLAND											
Maine:											
Portland	0	0	0	0	0	2	1	1	0	4	22
New Hampshire:											
Concord	0	0	0	0	0	0	0	0	0	0	6
Manchester	0	2	0	0	0	1	0	0	0	0	14
Vermont:											
Barre	1	0	0	0	0	0	0	0	0	0	1
Massachusetts:											
Boston	13	18	0	0	0	10	3	3	0	21	177
Fall River	1	0	0	0	0	5	2	0	0	1	31
Springfield	1	2	0	0	0	1	1	0	0	2	23
Worcester	2	5	0	0	0	2	0	0	0	3	28
Rhode Island:											
Pawtucket	0	0	0	0	0	0	0	0	0	0	10
Providence	2	1	0	0	0	3	2	1	0	4	63
Connecticut:											
Bridgeport	2	1	0	0	0	0	0	0	1	1	27
Hartford	1	2	0	0	0	2	1	1	0	4	36
New Haven	1	2	0	0	0	1	3	1	0	2	22
MIDDLE ATLANTIC											
New York:											
Buffalo	4	5	0	0	0	10	3	1	1	1	115
New York	23	38	0	2	0	[1] 83	42	50	2	79	1,070
Rochester	3	2	0	0	0	1	1	2	0	9	57
Syracuse	2	0	0	0	0	0	1	1	0	9	42
New Jersey:											
Camden	0	1	1	0	0	2	1	0	0	7	27
Newark	4	1	0	0	0	9	2	2	0	24	85
Trenton	0	0	0	0	0	0	1	2	0	5	30
Pennsylvania:											
Philadelphia	16	11	0	0	0	28	13	10	3	42	405
Pittsburgh	8	0	0	0	0	3	4	0	0	33	122
Reading	0	0	0	0	0	0	1	0	0	22	13
EAST NORTH CENTRAL											
Ohio:											
Cincinnati	3	3	0	0	0	12	3	1	0	5	141
Cleveland	7	15	0	0	0	19	5	5	1	73	164
Columbus	1	3	0	0	0	1	3	1	0	1	62
Toledo	5	1	1	1	0	5	3	2	1	39	73
Indiana:											
Fort Wayne	0	0	0	0	0	1	1	0	1	0	19
Indianapolis	2	1	1	2	0	1	3	1	1	21	103
South Bend	1	2	0	0	0	0	1	0	0	2	12
Terre Haute	1	0	1	0	0	0	0	0	0	0	16
Illinois:											
Chicago	23	18	0	1	0	49	6	7	0	71	536
Peoria	1	0	0	0	0	1	1	0	0	1	17
Springfield	0	1	0	0	0	1	1	2	0	3	13
Michigan:											
Detroit	20	17	2	0	0	15	5	8	2	80	201
Flint	3	2	0	0	0	2	1	0	0	2	17
Grand Rapids	1	1	0	0	0	2	1	0	0	5	34
Wisconsin:											
Kenosha	0	0	1	0	0	0	0	0	0	14	3
Madison	0	------	0	------	------	------	0	------	------	------	------
Milwaukee	7	3	1	0	0	5	1	0	0	53	76
Racine	1	0	0	0	0	2	0	0	0	0	10
Superior	1	2	0	0	0	0	0	0	0	0	5
WEST NORTH CENTRAL											
Minnesota:											
Duluth	3	10	1	0	0	0	0	1	0	2	23
Minneapolis	10	17	1	0	0	4	1	0	0	2	73
St. Paul	4	5	1	0	0	4	3	5	0	11	52

[1] Pulmonary tuberculosis only.

City reports for week ended August 21, 1926—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
WEST NORTH CENTRAL—continued											
Iowa:											
Davenport	0	3	0	0	-------	-------	0	0	-------	1	-------
Sioux City	1	0	1	1	-------	-------	0	0	-------	9	-------
Waterloo	1	0	0	0	-------	-------	0	0	-------	4	-------
Missouri:											
Kansas City	2	0	0	0	0	4	3	0	0	3	93
St. Joseph	1	0	0	0	0	2	1	1	0	0	10
St. Louis	6	16	0	1	0	6	8	12	1	11	163
North Dakota:											
Fargo	1	4	0	0	0	1	0	0	0	0	14
Grand Forks	1	0	0	0	-------	-------	0	0	-------	0	-------
South Dakota:											
Aberdeen	0	0	0	0	-------	-------	0	0	-------	1	-------
Sioux Falls	1	-------	0	-------	-------	-------	0	-------	-------	-------	-------
Nebraska:											
Lincoln	1	2	0	2	0	0	0	0	0	8	7
Omaha	1	2	1	0	0	1	1	1	1	3	47
Kansas:											
Topeka	1	4	0	0	0	0	1	3	0	5	20
Wichita	1	1	0	0	0	2	2	1	0	3	21
SOUTH ATLANTIC											
Delaware:											
Wilmington	0	0	0	0	0	0	0	2	0	1	25
Maryland:											
Baltimore	5	5	0	0	0	20	9	11	2	72	212
Cumberland	1	0	0	0	0	0	1	0	0	0	10
Frederick	1	0	0	0	0	0	0	0	0	1	3
District of Col.:											
Washington	2	6	0	0	0	6	5	4	0	14	90
Virginia:											
Lynchburg	1	1	0	0	0	0	1	2	0	4	16
Norfolk	0	1	0	1	0	2	2	4	0	3	-------
Richmond	2	5	0	0	0	1	2	6	1	1	31
Roanoke	0	0	0	0	0	1	2	1	0	0	20
West Virginia:											
Charleston	0	0	0	0	0	0	2	2	0	6	18
Huntington	0	0	0	0	0	1	2	0	0	0	25
Wheeling	1	0	0	0	0	0	1	0	1	1	16
North Carolina:											
Raleigh	1	1	0	0	0	1	0	0	0	26	16
Wilmington	1	0	0	0	0	1	1	1	0	3	9
Winston-Salem	0	0	1	0	0	1	3	0	0	0	21
South Carolina:											
Charleston	0	0	0	0	0	2	3	2	0	2	27
Columbia	1	1	0	0	0	0	1	1	0	0	-------
Greenville	0	0	1	0	0	0	1	0	0	0	8
Georgia:											
Atlanta	3	0	1	1	0	4	4	13	3	1	78
Brunswick	0	0	0	0	0	1	1	0	0	0	6
Savannah	1	0	0	0	0	2	2	0	0	0	30
Florida:											
Miami	-------	0	-------	0	0	0	-------	0	0	1	29
St. Petersburg	0	-------	0	-------	0	0	0	-------	0	-------	2
Tampa	0	1	0	1	0	3	0	1	2	0	34
EAST SOUTH CENTRAL											
Kentucky:											
Covington	0	0	1	0	0	1	0	1	0	0	19
Louisville	1	2	1	0	0	10	5	5	0	0	91
Tennessee:											
Memphis	1	0	0	0	0	3	7	16	2	8	49
Nashville	1	3	0	0	0	3	7	8	1	20	39
Alabama:											
Birmingham	3	2	0	0	0	5	7	2	0	17	57
Mobile	0	0	0	0	0	1	1	1	0	0	24
Montgomery	1	0	0	1	0	0	1	3	0	1	7

City reports for week ended August 21, 1926—Continued

Division, State, and city	Scarlet fever: Cases, estimated expectancy	Scarlet fever: Cases reported	Smallpox: Cases, estimated expectancy	Smallpox: Cases reported	Smallpox: Deaths reported	Tuberculosis, deaths reported	Typhoid fever: Cases, estimated expectancy	Typhoid fever: Cases reported	Typhoid fever: Deaths reported	Whooping cough, cases reported	Deaths, all causes
WEST SOUTH CENTRAL											
Arkansas:											
Fort Smith	1		0				0				
Little Rock	0	0	0	0	0	3	2	0	0	0	
Louisiana:											
New Orleans	1	2	0	0	0	9	5	4	0	2	146
Shreveport	0	0	0	0	0	1	5	1	0	0	20
Oklahoma:											
Oklahoma City	1	1	0	0	0	0	2	2	0	0	28
Texas:											
Dallas	2	2	0	0	0	3	4	4	0	9	54
Galveston	0	0	0	0	0	0	0	0	0	0	14
Houston	0	0	0	0	0	2	0	0	0	0	46
San Antonio	0	0	0	0	0	8	1	1	0	0	60
MOUNTAIN											
Montana:											
Billings	1	0	0	0	0	0	0	0	0	0	6
Great Falls	1	0	0	0	0	0	1	0	0	0	3
Helena	0	0	0	0	0	1	0	0	0	0	5
Missoula	0	0	0	0	0	0	1	1	0	0	4
Idaho:											
Boise	0	1	0	0	0	0	0	0	0	0	3
Colorado:											
Denver	2	3	2	0	0	4	3	1	0	3	65
Pueblo	0	0	0	0	0	2	1	5	0	0	9
New Mexico:											
Albuquerque	0	1	0	0	0	4	1	0	0	4	21
Arizona:											
Phoenix		1	0	0	0	4	0	0	0	0	12
Utah:											
Salt Lake City	1	0	0	0	0	0	2	1	0	10	31
Nevada:											
Reno	0	0	0	0	0	0	1	0	0	0	2
PACIFIC											
Washington:											
Seattle	3	1	1	1			2	2		11	
Spokane	2	9	1	0			1	2		9	
Tacoma	0	2	1	0	0	2	0	0	0	1	29
Oregon:											
Portland	3	9	4	1	0	3	1	1	0	1	
California:											
Los Angeles	6	9	2	1	0	20	4	3	0	4	196
Sacramento	1	0	1	0	0	0	1	1	1	0	29
San Francisco	5	8	0	0	0	6	2	1	0	2	150

Division, State, and city	Cerebrospinal meningitis: Cases	Cerebrospinal meningitis: Deaths	Lethargic encephalitis: Cases	Lethargic encephalitis: Deaths	Pellagra: Cases	Pellagra: Deaths	Poliomyelitis (infantile paralysis): Cases, estimated expectancy	Poliomyelitis: Cases	Poliomyelitis: Deaths
NEW ENGLAND									
Massachusetts:									
Boston	0	0	1	2	0	0	1	1	0
Fall River	0	0	0	0	0	0	1	1	0
Springfield	0	0	0	0	0	0	0	4	0
Worcester	0	0	1	1	0	0	0	10	1
Rhode Island:									
Providence	0	0	0	0	0	0	0	2	1
MIDDLE ATLANTIC									
New York:									
Buffalo	0	0	1	0	0	0	1	13	3
New York	3	4	5	4	0	0	8	5	0
Syracuse	0	0	0	0	0	0	0	4	3

City reports for week ended August 21, 1926—Continued

Division, State, and city	Cerebrospinal meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases, estimated expectancy	Cases	Deaths
EAST NORTH CENTRAL									
Ohio:									
Cleveland	0	0	0	1	0	1	0	0	1
Illinois:									
Chicago	1	0	2	0	0	0	5	1	0
Michigan:									
Flint	0	0	0	0	0	0	0	1	0
WEST NORTH CENTRAL									
Missouri:									
Kansas City	0	0	0	0	1	1	0	0	0
St. Louis	1	0	0	0	0	0	1	0	0
SOUTH ATLANTIC									
Maryland:									
Baltimore	0	0	2	0	0	0	1	2	2
Virginia:									
Roanoke	0	0	0	0	0	1	0	0	0
North Carolina:									
Raleigh	0	0	0	0	0	1	0	0	0
Winston-Salem	1	0	0	0	0	0	0	0	0
South Carolina:									
Charleston	0	0	1	0	1	0	0	0	0
Georgia:									
Brunswick	0	0	0	0	0	1	0	0	0
Florida:									
St. Petersburg	0	1	0	0	0	0	0	0	0
EAST SOUTH CENTRAL									
Kentucky:									
Louisville	0	0	1	2	0	0	0	0	0
WEST SOUTH CENTRAL									
Arkansas:									
Little Rock	0	0	0	0	0	2	0	0	0
Louisiana:									
New Orleans	0	0	0	0	2	2	0	0	0
Oklahoma:									
Oklahoma City	0	0	0	0	1	0	0	0	0
Texas:									
Galveston	0	0	0	0	0	2	0	0	0
MOUNTAIN									
Colorado:									
Denver	0	0	0	0	0	0	0	2	0
Utah:									
Salt Lake City	0	1	0	0	0	0	0	0	0
PACIFIC									
Washington:									
Spokane	1	0	0	0	0	0	0	1	0
California:									
Los Angeles	0	0	1	0	0	0	0	1	0
Sacramento	1	1	0	0	0	0	1	0	0
San Francisco	0	0	0	0	0	1	0	0	0

The following table gives the rates per 100,000 population for 102 cities for the five-week period ended August 21, 1926, compared with those for a like period ended August 22, 1925. The population figures used in computing the rates are approximate estimates as of July 1, 1925 and 1926, respectively, authoritative figures for many of the cities not being available. The 102 cities reporting cases had an

estimated aggregate population of nearly 30,000,000 in 1925 and nearly 30,500,000 in 1926. The 96 cities reporting deaths had more than 29,250,000 estimated population in 1925 and more than 29,750,000 in 1926. The number of cities included in each group and the estimated aggregate populations are shown in a separate table below.

Summary of weekly reports from cities, July 18 to August 21, 1926—Annual rates per 100,000 population—Compared with rates for the corresponding period of 1925 [1]

DIPHTHERIA CASE RATES

	Week ended—									
	July 25, 1925	July 24, 1926	Aug. 1, 1925	July 31, 1926	Aug. 8, 1925	Aug. 7, 1926	Aug. 15, 1925	Aug. 14, 1926	Aug. 22, 1925	Aug. 21, 1926
102 cities	75	[2] 90	[3] 75	[2] 80	[4] 83	[5] 78	77	[5] 69	68	[6] 68
New England	60	33	60	40	79	40	89	31	50	47
Middle Atlantic	90	109	92	103	83	88	78	62	73	59
East North Central	63	99	69	83	94	[7] 105	68	[7] 101	51	[7] 87
West North Central	103	[2] 95	97	[2] 85	[8] 105	[9] 52	107	[9] 56	99	[9] 85
South Atlantic	42	34	[3] 48	21	52	43	69	49	60	60
East South Central	11	10	11	21	26	10	32	57	58	21
West South Central	66	39	40	39	22	39	48	26	57	[10] 66
Mountain	111	64	148	91	[11] 66	118	157	73	74	146
Pacific	99	175	64	119	141	102	80	105	110	62

MEASLES CASE RATES

	July 25, 1925	July 24, 1926	Aug. 1, 1925	July 31, 1926	Aug. 8, 1925	Aug. 7, 1926	Aug. 15, 1925	Aug. 14, 1926	Aug. 22, 1925	Aug. 21, 1926
102 cities	101	[2] 155	[3] 70	[2] 103	[4] 51	[5] 66	46	[5] 57	30	[6] 41
New England	208	109	180	83	127	83	125	69	93	52
Middle Atlantic	127	108	77	63	69	42	57	33	88	27
East North Central	111	243	68	171	44	[7] 96	35	[7] 77	21	[7] 60
West North Central	18	[2] 183	30	[2] 93	[8] 10	[9] 58	24	[9] 66	6	[9] 29
South Atlantic	90	128	[3] 68	115	42	47	40	81	33	36
East South Central	58	125	26	93	11	42	16	31	5	36
West South Central	4	13	0	9	0	9	9	4	9	[10] 9
Mountain	37	173	102	127	[11] 19	137	18	64	28	18
Pacific	19	213	33	121	28	121	19	94	11	78

SCARLET FEVER CASE RATES

	July 25, 1925	July 24, 1926	Aug. 1, 1925	July 31, 1926	Aug. 8, 1925	Aug. 7, 1926	Aug. 15, 1925	Aug. 14, 1926	Aug. 22, 1925	Aug. 21, 1926
102 cities	55	[2] 83	[3] 54	[2] 73	[4] 51	[5] 61	57	[5] 51	51	[6] 48
New England	69	85	72	118	98	104	81	69	89	73
Middle Atlantic	42	75	37	52	33	38	36	30	23	29
East North Central	63	93	60	85	48	[7] 79	54	[7] 56	54	[7] 47
West North Central	115	[2] 127	121	[2] 143	[8] 117	[9] 101	129	[9] 119	143	[9] 123
South Atlantic	15	36	[3] 34	34	21	39	38	30	40	39
East South Central	26	93	58	62	58	31	37	47	32	36
West South Central	31	82	26	39	53	17	66	22	48	[10] 18
Mountain	157	64	83	36	[11] 38	64	92	36	65	36
Pacific	44	92	47	86	61	84	83	86	41	78

[1] The figures given in this table are rates per 100,000 population, annual basis—and not the number of cases reported. Populations used are estimated as of July 1, 1925 and 1926, respectively.
[2] Sioux Falls, S. Dak., not included.
[3] Tampa, Fla., not included.
[4] Waterloo, Iowa, and Helena, Mont., not included.
[5] Madison, Wis., and Sioux Falls, S. Dak., not included.
[6] Madison, Wis., Sioux City, Iowa, Sioux Falls, S. Dak., and Fort Smith, Ark., not included.
[7] Madison, Wis., not included.
[8] Waterloo, Iowa, not included.
[9] Sioux City, Iowa, and Sioux Falls, S. Dak., not included.
[10] Fort Smith, Ark., not included.
[11] Helena, Mont., not included.

Summary of weekly reports from cities, July 18 to August 21, 1926—Annual rates per 100,000 population—Compared with rates for the corresponding period of 1925—Continued

SMALLPOX CASE RATES

	Week ended—									
	July 25, 1925	July 24, 1926	Aug. 1, 1925	July 31, 1926	Aug. 8, 1925	Aug. 7, 1926	Aug. 15, 1925	Aug. 14, 1926	Aug. 22, 1925	Aug. 21, 1926
102 cities	10	[2] 6	[3] 9	[2] 5	[4] 9	[5] 8	7	[5] 7	6	[6] 2
New England	5	0	0	0	0	0	0	0	0	0
Middle Atlantic	0	0	0	1	0	1	0	0	0	1
East North Central	8	8	3	6	6	[7] 9	3	[7] 1	2	[7] 2
West North Central	12	[2] 14	14	[2] 4	[8] 8	[2] 14	16	[2] 4	6	[9] 2
South Atlantic	15	6	[3] 2	2	2	11	2	11	4	6
East South Central	37	10	21	5	47	16	21	26	37	5
West South Central	4	13	4	4	13	13	9	22	4	[10] 0
Mountain	0	27	55	9	[11] 19	9	9	73	9	0
Pacific	64	8	80	32	64	24	64	32	41	5

TYPHOID FEVER CASE RATES

	July 25, 1925	July 24, 1926	Aug. 1, 1925	July 31, 1926	Aug. 8, 1925	Aug. 7, 1926	Aug. 15, 1925	Aug. 14, 1926	Aug. 22, 1925	Aug. 21, 1926
102 cities	33	[2] 18	[3] 40	[2] 30	[4] 40	[5] 29	46	[5] 35	55	[6] 41
New England	22	9	22	14	26	12	38	17	31	17
Middle Atlantic	21	9	30	23	23	19	33	24	44	34
East North Central	8	6	10	10	20	[7] 12	17	[7] 19	29	[7] 17
West North Central	38	[2] 12	46	[2] 22	[8] 41	[2] 18	55	[2] 24	46	[9] 56
South Atlantic	50	47	[3] 64	54	56	66	86	100	104	94
East South Central	163	135	168	259	252	182	200	140	168	187
West South Central	163	30	154	47	123	60	97	47	128	[10] 44
Mountain	46	46	55	36	[11] 104	27	102	73	102	73
Pacific	28	8	44	11	17	30	41	30	61	24

INFLUENZA DEATH RATES

	July 25, 1925	July 24, 1926	Aug. 1, 1925	July 31, 1926	Aug. 8, 1925	Aug. 7, 1926	Aug. 15, 1925	Aug. 14, 1926	Aug. 22, 1925	Aug. 21, 1926
96 cities	2	[2] 3	[3] 1	[2] 2	[11] 2	[5] 2	2	[5] 1	2	[6] 3
New England	0	2	0	0	5	0	0	0	0	0
Middle Atlantic	3	2	1	1	2	2	3	1	2	1
East North Central	1	4	0	1	3	[7] 1	3	[7] 0	1	[7] 3
West North Central	4	[2] 2	0	[2] 0	0	[2] 0	0	[2] 2	0	[9] 2
South Atlantic	4	4	[3] 2	2	6	4	0	0	0	2
East South Central	5	5	0	5	5	0	5	10	11	0
West South Central	0	9	0	24	5	5	0	14	10	28
Mountain	9	9	0	0	[11] 0	9	9	0	9	0
Pacific	0	4	0	4	0	11	0	0	7	7

PNEUMONIA DEATH RATES

	July 25, 1925	July 24, 1926	Aug. 1, 1925	July 31, 1926	Aug. 8, 1925	Aug. 7, 1926	Aug. 15, 1925	Aug. 14, 1926	Aug. 22, 1925	Aug. 21, 1926
96 cities	48	[2] 54	[3] 59	[2] 48	[11] 52	[5] 54	60	[5] 50	53	[6] 54
New England	50	33	53	33	36	54	29	31	38	40
Middle Atlantic	51	64	65	41	65	56	73	62	65	58
East North Central	37	46	48	48	36	[7] 42	47	[7] 35	40	[7] 34
West North Central	40	[2] 46	40	[2] 57	51	[2] 51	42	[2] 25	30	[9] 49
South Atlantic	52	58	[3] 60	51	50	68	73	56	60	86
East South Central	58	90	68	62	63	52	58	52	74	36
West South Central	63	57	116	76	68	104	82	113	77	71
Mountain	55	64	74	55	[11] 28	64	55	82	65	82
Pacific	58	35	62	71	69	57	80	39	47	78

[2] Sioux Falls, S. Dak., not included.
[3] Tampa, Fla., not included.
[4] Waterloo, Iowa, and Helena, Mont., not included.
[5] Madison, Wis., and Sioux Falls, S. Dak., not included.
[6] Madison, Wis., Sioux City, Iowa, Sioux Falls, S. Dak., and Fort Smith, Ark., not included.
[7] Madison, Wis., not included.
[8] Waterloo, Iowa, not included.
[9] Sioux City, Iowa, and Sioux Falls, S. Dak., not included.
[10] Fort Smith, Ark., not included.
[11] Helena, Mont., not included.

Number of cities included in summary of weekly reports, and aggregate population of cities in each group, approximated as of July 1, 1925 and 1926, respectively

Group of cities	Number of cities reporting cases	Number of cities reporting deaths	Aggregate population of cities reporting cases		Aggregate population of cities reporting deaths	
			1925	1926	1925	1926
Total	102	96	29,930,185	30,458,186	29,251,658	29,764,201
New England	12	12	2,176,124	2,206,124	2,176,124	2,206,124
Middle Atlantic	10	10	10,346,970	10,476,970	10,346,970	10,476,970
East North Central	16	16	7,481,656	7,655,436	7,481,656	7,655,436
West North Central	13	11	2,580,151	2,619,719	2,461,380	2,499,036
South Atlantic	21	21	2,716,070	2,776,070	2,716,070	2,776,070
East South Central	7	7	993,103	1,004,953	993,103	1,004,953
West South Central	8	6	1,184,057	1,212,057	1,078,198	1,103,695
Mountain	9	9	563,912	572,773	563,912	572,773
Pacific	6	4	1,888,142	1,934,084	1,434,245	1,469,144

FOREIGN AND INSULAR

CHOLERA ON VESSEL

Steamship "Macedonia"—Yokohama, Japan—August 5, 1926.—On August 5, 1926, a case of cholera was found on the steamship *Macedonia* at Yokohama, Japan. The *Macedonia* sailed from Singapore July 18, 1926.

THE FAR EAST

Report for week ended August 7, 1926.—The following report for the week ended August 7, 1926, was transmitted by the far eastern bureau of the health section of the secretariat of the League of Nations to the headquarters at Geneva:

Maritime towns	Plague		Cholera		Smallpox		Maritime towns	Plague		Cholera		Smallpox	
	Cases	Deaths	Cases	Deaths	Cases	Deaths		Cases	Deaths	Cases	Deaths	Cases	Deaths
Egypt—Alexandria	0	1	0	0	2	1	Siam—Bangkok	0	0	8	2	4	4
British India:							Dutch East Indies—						
Bombay	----	0	----	0	7	3	Cheribon [1]	0	0	0	0	1	0
Madras	----	0	----	1	12	----	French Indo-China—						
Rangoon	----	5	----	1	0	0	Saigon and Cholon	1	0	1	0	0	0
Negapatam	----	0	----	3	0	0	China:						
Karachi	----	0	----	0	1	0	Amoy	2	----	0	0	0	0
Vizagapatam	----	0	----	0	2	0	Shanghai	----	----	----	----	----	----

[1] One plague-infected rat was found in the port during the week.

Telegraphic reports from the following maritime towns indicated that no case of plague, cholera, or smallpox was reported during the week:

ASIA

Iraq.—Basra.

British India.—Chittagong, Cochin, Tuticorin.

Ceylon.—Colombo.

Federated Malay States.—Port Swettenham.

Straits Settlements.—Penang, Singapore.

Dutch East Indies.—Batavia, Surabaya, Samarang, Belawan-Deli, Palembang, Sabang, Makassar, Menado, Banjermasin, Balik-Papan, Tarakan, Padang, Samarinda.

Sarawak.—Kuching.

British North Borneo.—Sandakan, Jesselton, Kudat, Tawao.

Portuguese Timor.—Dilly.

Philippine Islands.—Manila, Iloilo, Jolo, Cebu, Zamboanga.

French Indo-China.—Turane, Haiphong.

China.—Hongkong.

Formosa.—Keelung.

Kwantung.—Port Arthur, Dairen.

Japan.—Yokohama, Osaka, Nagasaki, Moji, Kobe, Niigata, Tsuruga, Hakodate, Simonoseki.

Korea.—Chemulpo, Fusan.

Manchuria.—Antung, Mukden, Changchun, Harbin.

U. S. S. R.—Vladivostok.

AUSTRALASIA AND OCEANIA

Australia.—Adelaide, Melbourne, Sydney, Brisbane, Rockhampton, Townsville, Port Darwin, Broome, Fremantle, Carnarvon, Thursday Island.

New Guinea.—Port Moresby.

New Zealand.—Auckland, Wellington, Christchurch, Invercargill, Dunedin.

New Caledonia.—Noumea.

Fiji.—Suva.

Hawaii.—Honolulu.

AFRICA

Egypt.—Port Said, Suez.

Anglo-Egyptian Sudan.—Port Sudan, Suakin.

Eritrea.—Massaua.

French Somaliland.—Jibuti.

British Somaliland.—Berbera.

Italian Somaliland.—Mogadiscio.

Kenya.—Mombasa.

Zanzibar.—Zanzibar.

Tanganyika.—Dar-es-Salaam.

Seychelles.—Victoria.

Mauritius.—Port Louis.

Madagascar.—Tamatave, Majunga.

Portuguese East Africa.—Mozambique, Beira, Lourenço-Marques.

Union of South Africa.—Durban, East London, Port Elizabeth, Cape Town.

Reports had not been received in time for distribution from—

British India.—Calcutta.

Dutch East Indies.—Pontianak.

China.—Shanghai.

ALGERIA

Plague—Bona—August 14, 1926.—A case of plague was reported, August 14, 1926, at Bona, Algeria.

CANADA

Communicable diseases—Week ended August 21, 1926.—The Canadian Ministry of Health reports cases of certain communicable diseases in six Provinces of Canada for the week ended August 21, 1926, as follows:

Disease	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Total
Cerebrospinal fever			1	1		1	3
Influenza	10						10
Poliomyelitis		2		2			4
Smallpox				7	2	1	10
Typhoid fever	2	4	7	9	6		28

7237°—26†——4

Vital statistics—Quebec—June, 1926.—Births and deaths in the Province of Quebec for the month of June, 1926, have been reported as follows:

Estimated population	2,570,000
Births	6,653
Birth rate per 1,000 population	31.06
Deaths (all causes)	2,884
Death rate per 1,000 population	13.46
Deaths under 1 year	837
Infant mortality rate	125.80
Deaths from—	
Cancer	123
Cerebrospinal meningitis	10
Diabetes	20
Diphtheria	32
Deaths from—Continued.	
Heart diseases	404
Influenza	95
Measles	30
Poliomyelitis (infantile paralysis)	1
Scarlet fever	14
Syphilis	18
Tuberculosis (pulmonary)	235
Tuberculosis (other forms)	69
Typhoid fever	22
Whooping cough	41

CANARY ISLANDS

Plague—Teneriffe—August 2, 1926.—Information received under date of August 5, 1926, shows two cases of plague reported present August 2, 1926, at Teneriffe, Canary Islands, occurring in the Cristianos district.

CHINA

Cholera—Swatow.—During the week ended July 31, 1926, 14 cases of cholera were reported at Swatow, China. It was stated that the mortality from the disease was low.

ECUADOR

Plague—Guayaquil—July 16–31, 1926.—During the period July 16 to 31, 1926, five cases of plague with two deaths were reported at Guayaquil, Ecuador.

Plague-infected rats.—During the same period, of 10,148 rats taken 14 were found plague infected.

EGYPT

Plague—July 23–29, 1926.—Plague has been reported in Egypt as follows: In cities—Alexandria, July 27, two cases; Suez, July 29, two cases, bubonic; in Provinces—Behera, July 23–29, two cases, bubonic; Charkieh, July 27, one case fatal, septicemic; Minieh, July 24, one case, fatal, bubonic.

Plague in Egypt—January 1–July 29, 1926

Place	Cases	Deaths	Date of first case 1926	Date of last case 1926
City:				
Alexandria	5	1	Mar. 10	July 27
Suez	18	11	Mar. 27	July 29
Province:				
Behera	20	7	June 3	July 29
Beni-Suef	45	24	May 10	July 15
Charkieh	1	1	June 27	July 27
Dakahlia	1	1	Apr. 22	May 22
Fayoum	1	1	May 4	May 4
Gharbieh	12	6	Mar. 9	June 2
Girgeh	6	4	June 26	July 3
Minieh	3	2	Mar. 4	July 24

FINLAND

Communicable diseases—June, 1926.—During the month of June, 1926, communicable diseases were reported in the Republic of Finland as follows:

Disease	Cases	Disease	Cases
Diphtheria	42	Poliomyelitis	3
Dysentery	6	Scarlet fever	96
Lethargic encephalitis	2	Typhoid fever	40
Paratyphoid fever	135		

FRANCE

Plague—Saint Ouen—August 14, 1926.—Two cases of plague were reported at St. Ouen, a suburb of Paris, France, August 14, 1926.

GERMANY

Mortality—Karlsruhe, Baden—Year 1925 (comparative).—Information received under date of July 30, 1926, relative to vital statistics of the city of Karlsruhe, Baden, shows for the year 1925 the occurrence of 1,748 deaths from all causes in a population of 144,700; previous year, 1,738. For the years 1918, 1921, and 1923 the number of deaths were 2,320, 1,907, and 1,962, respectively. The decrease for the years 1924 and 1925 was stated to have been mainly due to decreased infant mortality, and this improvement was attributed to improved living conditions and better education in the care and treatment of infants.

Causes of death.—During the year 1925 tuberculosis caused 206 deaths, of which 167 were of tuberculosis of the lungs and larynx.

Cancer.—Increased mortality from cancer has been noted. In 1924 there were reported 206 deaths from cancer; in 1925 the number fell to 199; from 1920 to 1923 the number varied from 154 to 146.

GUATEMALA

Gastroenteritis—Guatemala—July, 1926.—During the month of July, 27 deaths from gastroenteritis were reported at Guatemala. Population, 220,000.

JAPAN

Further relative to plague at Yokohama.—Under date of August 7, 1926, two additional cases of plague [1] were reported at Yokohama, Japan, occurring within the city limits but not at the same distance from the original focus. One case occurred in a coolie employed in the canal section and one in an employee of a silk warehouse, a large reinforced building outside the customs compound.

[1] Public Health Reports, Aug. 27, 1926, p. 1867.

MEXICO

Gastroenteritis — Chihuahua — Mazatlan — August 16-22, 1926.— During the week ended August 22, 1926, 7 deaths from gastroenteritis were reported at Chihuahua and 7 at Mazatlan, Mexico. Population, 48,000 and 25,000, respectively.

VENEZUELA

Gastroenteritis—Caracas—July, 1926.—During the month of July, 1926, 58 deaths from gastroenteritis were reported at Caracas, Venezuela. Of these, 42 deaths were in children under two years of age; 16 were in persons over two years.

VIRGIN ISLANDS

Communicable diseases—July, 1926.—Communicable diseases were reported in the Virgin Islands of the United States during the month of July, 1926, as follows:

Island and disease	Cases	Remarks
St. Thomas and St. John:		
Chancroid	1	St. Croix.
Gonorrhea	4	St. John, 1.
Syphilis	3	Secondary.
Tuberculosis	2	Chronic pulmonary
St. Croix:		
Chancroid	6	
Gonorrhea	3	
Leprosy	1	
Mumps	2	

YUGOSLAVIA

Communicable diseases—July, 1926.—During the month of July, 1926, communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	31	4	Rabies	4	4
Cerebrospinal meningitis	6	9	Scarlet fever	285	68
Diphtheria	97	8	Tetanus	30	19
Dysentery	166	16	Typhoid fever	198	23
Glanders	1	1	Typhus fever	2	1
Measles	277	6	Whooping cough	225	3

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

The reports contained in the following tables must not be considered as complete or final as regards either the lists of countries included or the figures for the particular countries for which reports are given.

Reports Received During Week Ended September 10, 1926 [1]

CHOLERA

Place	Date	Cases	Deaths	Remarks
China:				
Shanghai	July 25-Aug. 1	8	189	Cases, foreign; deaths, native and foreign.
Swatow	July 18-24		48	Reported by police. Possibly not all actually cholera cases.
Do	July 25-31	14		Mortality stated to be low.
Tsingtao	do		1	
India:				
Bombay	July 18-24	1	1	
Indo-China:				
Saigon	July 4-17	8	2	
On vessel:				
Steamship Macedonia	Aug. 5	1		At Yokohama, Japan. Vessel sailed from Singapore July 18, 1926.

PLAGUE

Place	Date	Cases	Deaths	Remarks
Algeria:				
Bona	Aug. 14	1		
British East Africa:				
Uganda				Apr. 1-30, 1926: Cases, 100; deaths, 88. May, 1926: Cases, 314; deaths, 234.
Canary Islands:				
Teneriffe	Aug. 2	2		
China:				
Foochow	July 11-24			Present, not epidemic.
Swatow	July 25-31	14		
Ecuador:				
Guayaquil	July 16-31	5	2	Rats taken, 10,146; found infected, 14.
Egypt				Jan. 1-July 22, 1926: Cases, 104; for corresponding period, 1925—Cases, 88.
City—				
Alexandria	July 27	2		
Suez	July 29	2		Bubonic.
Province—				
Behera	July 23-29	2		Do.
Charkieh	July 27	1	1	Septicemic.
Minieh	July 24	1	1	Bubonic.
France:				
Saint Ouen	Aug. 14	2		Suburb of Paris.
Greece:				
Patras	July 25-Aug. 7	5	2	
India:				
Bombay	July 18-24	1	1	
Madras Presidency	July 4-10	28	15	
Iraq:				
Baghdad	July 18-24	1	1	
Japan:				
Yokohama	Aug. 7	2		
Java:				
Batavia	July 10-16	7	7	Province.

SMALLPOX

Place	Date	Cases	Deaths	Remarks
Belgium:				
Antwerp	Aug. 1-7	1	1	
Brazil:				
Bahia	July 11-17	1		
Pernambuco	July 11-17	1		
Rio de Janeiro	July 4-10	54	22	Jan. 1-July 31, 1926: Cases, 1,379; deaths, 689.
Do	July 11-17	126	48	
Do	July 18-24	142	80	
Do	July 25-31	186	85	

[1] From medical officers of the Public Health Service, American consuls, and other sources.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

Reports Received During Week Ended September 10, 1926—Continued

SMALLPOX—Continued

Place	Date	Cases	Deaths	Remarks
British East Africa:				
Mombasa	July 5-11	5	4	
Tanganyika				May, 1926: Cases, 252; deaths, 46.
Uganda				April, 1926: One case. May, 1926: One case.
Canada:				
British Columbia—				
Vancouver	Aug. 16-22	2		
Manitoba				Aug. 15-21, 1926: Cases, 2.
Winnipeg	Aug. 15-28	5		
Ontario				Aug. 15-21: 1926: Cases, 7.
Saskatchewan				Aug. 15-21, 1926: Case, 1.
China:				
Chungking	July 18-31			Present.
Foochow	July 11-24			Do.
Manchuria—				
Harbin	July 22-28	5		
South Manchurian Ry.	July 25-31	5		At stations.
Swatow	July 18-31			Sporadic.
Great Britain:				
England and Wales				Aug. 1-14, 1926: Cases, 134.
Sheffield	Aug. 1-7	1		
India:				
Bombay	July 18-24	16	4	
Madras	July 25-31	3	1	
Java:				
East Java and Madoera	June 19-July 3	22	1	
Mexico:				
Mexico City	July 25-31	1		Including municipalities in Federal district.
Siam:				
Bangkok	July 11-17	9	7	

TYPHUS FEVER

Place	Date	Cases	Deaths	Remarks
Chile:				
Concepcion	June 1-7		1	
China:				
Antung	July 26-Aug. 1	3		
Egypt:				
Alexandria	July 16-22	1		
Cairo	Feb. 18-25	47	7	
Mexico:				
Mexico City	July 25-31	3		Including municipalities in Federal district.
Palestine:				
Majdal District	July 27-Aug. 2	1		
Yugoslavia	July 1-31	2	1	

YELLOW FEVER

Place	Date	Cases	Deaths	Remarks
Brazil:				
Bahia	July 4-10	1		

Reports Received from June 26 to September 3, 1926 [1]

CHOLERA

Place	Date	Cases	Deaths	Remarks
Ceylon				Apr. 18-May 29, 1926: Cases, 31; deaths, 29.
China:				
Shanghai	Reported July 20	35	8	
Swatow	July 11-17		15	

[1] From medical officers of the Public Health Service, American consuls, and other sources.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

Reports Received from June 26 to September 3, 1926—Continued

CHOLERA—Continued

Place	Date	Cases	Deaths	Remarks
French Settlements in India				Mar. 7-May 15, 1926: Cases, 19; deaths, 18.
India				Apr. 25-June 26, 1926: Cases, 18,526; deaths, 11,53[illegible].
Bombay	May 30-June 5	1	1	
Calcutta	Apr. 4-May 29	478	418	
Do	June 13-26	73	69	
Do	June 27-July 10	87	82	
Madras	May 16-June 5	2	1	
Rangoon	May 9-June 26	67	44	
Do	June 27-July 10	16	17	
Indo-China:				
Saigon	May 2-15	52	48	
Do	May 22-June 26	42	32	
Do	June 27-July 3	19	14	
Japan:				
Yokohama	Aug. 25	1		
Philippine Islands:				
Manila	May 18-24	2	2	
Do	June 27-July 17	4	1	
Provinces—				
Albay	Apr. 18-24	1	1	
Mindoro	Feb. 21-Mar. 6	3	3	
Romblon	Dec. 14-31	42	43	
Do	Jan. 2-23	16	12	
Siam:				
Bangkok	May 2-June 12	1,325	736	
Do	June 20-26	56	26	
Do	June 27-July 10	54	22	

PLAGUE

Place	Date	Cases	Deaths	Remarks
Algeria:				
Algiers	June 21-30	1		Under date of July 16, 2 cases reported.
Azores:				
Fayal Island—				
Horta	Aug. 2-8	1	1	
St. Michaels Island	May 9-June 26	7	2	
British East Africa:				
Kisumu	May 16-22	1	1	
Uganda	Mar. 1-31	35	34	
Ceylon:				
Colombo	May 29-June 5	1	1	
Chile:				
Iquique	June 20-26		1	
China:				
Amoy	Apr. 18-June 26	40	30	
Do	June 27-July 24	21		
Foochow	June 6-12			Several cases. Not epidemic.
Nanking	May 9-July 24			Prevalent.
Ecuador:				
Guayaquil	May 16-June 30	6		Rats taken, 30,914; found infected, 31.
Do	July 1-15			Rats taken, 10,020; found infected, 8.
Egypt				Jan. 1-July 8, 1926: Cases, 100.
City—				
Suez	May 21-July 1	9	5	
Provinces—				
Beni-Suef	May 28-June 8	8	2	
Gharbieh	June 2	1	1	
France:				
Marseille	July 8	1	1	Reported July 24.
St. Denis	Reported Aug. 2	1		Vicinity of Paris.
Greece:				
Athens	Apr. 1-May 31	16	4	Including Piræus.
Patras	May 27-June 12	4	1	
Zante	May 17	1		
Hawaii:				
Paauhau	July 18-24			Plague-infected rat trapped.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

Reports Received from June 26 to September 3, 1926—Continued

PLAGUE—Continued

Place	Date	Cases	Deaths	Remarks
India				Apr. 25–June 26, 1926: Cases, 53,001; deaths, 41,576.
Bombay	May 2–June 26	16	15	
Karachi	May 23–June 26	15	13	
Do	July 11–17	1	1	
Madras Presidency	Apr. 25–June 26	162	93	
Do	July 18–24	18	12	
Rangoon	May 9–June 26	20	15	
Do	June 27–July 10	3	4	
Indo-China:				
Saigon	May 23–June 26	8	3	
Iraq:				
Baghdad	Apr. 18–June 12	161	108	
Japan:				
Yokohama	July 2–30	9	5	Total: July 2–Aug. 2, 1926: Cases, 9; deaths, 7.
Java:				
Batavia	Apr. 24–June 19	65	65	
Do	June 26–July 9	18	17	
Cheribon	Apr. 11–24	3	3	
East Java and Madoera	June 13–19	1	1	
Madagascar:				
Ambositra Province	May 1–15	4	4	Septicemic.
Moramanga Province	Apr. 1–15	2	2	Do.
Tananarive Province				Apr. 1–June 15, 1926: Cases, 120; deaths, 111.
Tamatave (Port)	May 16–31	1	1	
Tananarive Town	Apr. 1–May 15	6	6	
Other localities	do	80	77	Bubonic, pneumonic, septicemic.
Nigeria				Feb. 1–Apr. 30, 1926: Cases, 115; deaths, 92.
Peru				May–June, 1926: Cases, 57; deaths, 16.
Departments—				
Ancash	May 1–31			Present.
Cajamarca	May 1–June 30	10	4	
Ica	May 1–31	1		
Libertad	do	4		Pacasmayo, cases, 2; Trujillo district, cases, 2.
Lima	May 1–June 30	29	12	
Piura	June 1–30	13		In Huancabamba district.
Russia				Jan. 1–Mar. 31, 1926: Cases, 37.
Senegal				Nov. 1–30, 1926: Cases, 3; deaths, 2. Mar. 1–Apr. 30, 1926: Cases, 15; deaths, 4.
Siam:				
Bangkok	May 23–June 26	2	2	
Straits Settlements:				
Singapore	May 2–8	1	1	
Syria:				
Beirut	July 1–10	1		
Tunisia	May 11–June 20	150		
Kairouan	June 9	3		9 cases 30 miles south of Kairouan.
Union of South Africa:				
Cape Province	May 16–22	5	3	
Calvinia District	June 13–26	12	6	
Do	June 27–July 3	1		
Williston District	June 13–26	2		
Do	June 27–July 3	1		
Orange Free State—				
Hoopstad District—				
Protestpan	May 9–22	3	3	

SMALLPOX

Place	Date	Cases	Deaths	Remarks
Algeria:				
Algiers	May 21–June 30	14		
Do	July 1–10	1		
Bolivia:				
La Paz	May 1–June 30	14	7	
Brazil:				
Bahia	June 20–26	1		
Do	June 27–July 10	1	7	
Manaos	Apr. 1–30		5	
Para	May 16–June 26	26	25	
Do	June 27–July 31	14	8	
Rio de Janeiro	May 2–June 19	132	91	
Santos	Mar. 1–7		1	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

Reports Received from June 26 to September 3, 1926—Continued

SMALLPOX—Continued

Place	Date	Cases	Deaths	Remarks
British East Africa:				
Tanganyika	May 2-22		12	
Uganda	Mar. 1-31	1		
British South Africa:				
Northern Rhodesia	May 18-24	17	6	Natives.
Do	June 8-14	5		
Canada				May 30-June 12, 1926: Cases, 46.
Alberta	May 30-June 12	3		
Do	June 27-July 1	1		
Manitoba	May 30-June 26	24		
Do	June 27-July 24	7		
Winnipeg	June 6-12	5	1	
Do	July 4-17	6		
Ontario				May 30-June 26, 1926: Cases, 36. June 27-Aug. 14: Cases, 49.
Fort William	July 25-Aug. 7	2		
Kingston	May 23-June 26	5		
Do	July 11-17	2	1	
Kitchener	Apr. 26-May 29	3	1	
North Bay	May 2-22	5		
Do	July 25-31	2		
Orillia	Apr. 26-May 29	7		
Ottawa	July 18-24	1		
Packenham	do	10		
Toronto	do	7		
Waterloo	do	6		
Saskatchewan				May 30-June 19, 1926: Cases, 16. June 27-Aug. 14: Cases, 37.
Regina	July 4-10	2		
Ceylon				Mar. 14-May 29, 1926: Cases, 44; deaths, 3.
Chile:				
Antofagasta	June 6-12	1		
China:				
Amoy	May 1-June 26	4	8	
Do	July 4-10	1		
Antung	May 17-June 19	5		
Do	July 4-18	2		
Canton	May 1-31	4	2	
Chungking	May 2-July 17			Present.
Foochow	May 2-July 10			Do.
Hongkong	May 2-June 26	19	10	
Do	June 27-July 3	1	1	
Manchuria	July 6-24	13		Railway stations.
An-shan	May 16-June 12	5		South Manchurian Railway.
Antung	May 16-June 19	5		
Changchun	May 16-June 26	6		Do.
Do	June 27-July 3	1		Do.
Dairen	Apr. 26-June 20	69	16	
Do	June 28-July 18	3	2	
Fushun	May 16-June 5	4		Do.
Harbin	May 14-June 30	21		Do.
Do	July 1-21	7		
Kai-yuan	May 16-June 30	10		Do.
Kungchuling	June 13-19	1		Do.
Liao-yang	May 16-June 30	4		Do.
Mukden	do	4		Do.
Penhsihu	May 16-June 19	4		Do.
Ssupingkai	May 16-June 30	2		Do.
Teshihchiao	do	2		Do.
Wa-feng-tien	do	3		Do.
Nanking	May 8-July 24			Present.
Shanghai	May 2-June 26	10	25	Cases: Foreign. Deaths, population of international concession, foreign and native.
Do	June 27-July 24	3	3	
Swatow	May 9-July 10			Sporadic.
Tientsin	June 2-26		1	Reported by British municipality.
Wanshien	May 1			Prevalent.
Chosen				Mar. 1-Apr. 30, 1926: Cases, 368; deaths, 85.
Fusan	May 1-31	1		
Seishun	do	2	1	
Egypt:				
Alexandria	May 15-July 1	18	3	
Cairo	Jan. 29-Feb. 4	1	1	
Esthonia				May 1-June 30, 1926: Cases, 3.
France				Mar. 1-Apr. 30, 1926: Cases, 92.
St. Etienne	Apr. 18-June 15	7	2	
French Settlements in India	Mar. 7-May 15	205	205	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

Reports Received from June 26 to September 3, 1926—Continued

SMALLPOX—Continued

Place	Date	Cases	Deaths	Remarks
Gold Coast	Mar. 1-Apr. 30	626	13	
Great Britain:				
England and Wales				May 23-July 3, 1926: Cases, 1,068. July 4-31, 1926: Cases, 376.
Bradford	May 23-29	1		
Newcastle-on-Tyne	June 6-12	1		
Do	July 11-17	1		
Nottingham	May 2-June 5	7		
Sheffield	June 13-19	1		
Do	July 4-10	1		
Greece:				
Saloniki	June 1-14		3	
Guatemala:				
Guatemala City	June 1-30		2	
India				Apr. 25-June 26, 1926: Cases, 54,851; deaths, 14,771.
Bombay	May 2-June 26	220	134	
Do	June 27-July 17	54	30	
Calcutta	Apr. 4-May 29	171	152	
Do	June 13-26	24	18	
Do	June 27-July 10	13	12	
Karachi	May 16-June 26	44	18	
Do	June 27-July 24	8	4	
Madras	May 16-June 26	7	4	
Do	June 27-July 24	6	3	
Rangoon	May 9-June 26	10	5	
Do	July 4-10	1		
Indo-China:				
Saigon	do	2		
Iraq:				
Baghdad	May 9-June 26	8	3	
Do	July 4-10	1	1	
Basra	Apr. 18-June 22	34	25	
Italy				Mar. 28-June 5, 1926: Cases, 26.
Rome	June 14-20	4		Entire consular district, including Island of Sardinia.
Jamaica				Apr. 25-June 26, 1926: Cases, 201. (Reported as alastrim.)
Do				June 27-July 31, 1926: Cases, 85. (Reported as alastrim.)
Japan				Apr. 11-May 29, 1926: Cases, 564.
Kobe	May 30-June 5	1		
Nagoya	May 16-22		1	
Do	July 4-10	1		
Taiwan Island	May 11-20	24		
Do	June 1-20	23		
Tokyo	June 26-July 3	2		
Yokohama	May 2-8	2		
Java:				
Batavia	May 15-June 25	2		Province.
East Java and Madoera	Apr. 11-June 19	78	5	
Malang	Apr. 4-10	6	1	Interior.
Surabaya	May 16-22	14	1	
Latvia				Apr. 1-30, 1926: Cases, 3.
Mexico				Feb. 1-Mar. 31, 1926: Deaths, 602.
Aguascalientes	June 13-26		5	
Guadalajara	June 8-14		2	
Do	June 29-Aug. 16		5	
Mexico City	May 16-June 5	3		Including municipalities in Federal District.
Saltillo	July 18-24		1	
San Antonio de Arenales	Jan. 1-June 30			Present: 100 miles from Chihuahua.
San Luis Potosi	June 13-26		7	
Do	July 4-Aug. 14		9	
Tampico	June 1-10		2	
Torreon	May 1-June 30		17	
Do	July 1-31		5	
Netherlands:				
Amsterdam	July 18-24		6	
Nigeria				Feb. 1-Apr. 30, 1926: Cases, 404; deaths, 33.
Persia:				
Teheran	Apr. 21-May 21		7	
Peru:				
Arequipa	June 1-30		1	
Poland				Mar. 28-May 1, 1926: Cases, 12; deaths, 1.
Portugal:				
Lisbon	Apr. 26-June 19	10	3	
Oporto	May 23-June 5	4		
Do	July 11-24	2		

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

Reports Received from June 26 to September 3, 1926—Continued

SMALLPOX—Continued

Place	Date	Cases	Deaths	Remarks
Russia				Jan. 1–Mar. 31, 1926: Cases, 2,103.
Siam:				
Bangkok	May 2–June 12	23	20	
Do	July 4–10	15	16	
Straits Settlements:				
Singapore	Apr. 25–May 1	1		
Switzerland:				
Lucerne Canton	June 1–30	1		
Tunisia				Apr. 1–June 30, 1926: Cases, 17.
Union of South Africa:				
Cape Province	June 20–26			Outbreaks.
Idutya district	May 23–29			Do.
Orange Free State	June 20–July 3			Do.
Natal	May 30–June 5			Do.
Transvaal				June 6–12, 1926: Outbreaks in Pietersburg and Rustenburg districts.
Johannesburg	May 9–June 12	5		
Do	July 11–17	1		
Yugoslavia				Apr. 15–30, 1926: Cases, 2; deaths, 1.
On vessel				Three cases, 1 death, at Aden, Arabia, stated to have been imported by sea.
S. S. Karapara				At Zanzibar, June 7, 1926. One case of smallpox landed. At Durban, Union of South Africa, June 16, 1926: One suspect case landed.
Steamship	July 2	1		Vessel from Glasgow, Scotland, for Canada. Patient from Glasgow; removed at quarantine on outward voyage.

TYPHUS FEVER

Place	Date	Cases	Deaths	Remarks
Algeria:				
Algiers	May 21–June 30	7	1	
Argentina:				
Rosario	Feb. 1–28	2		
Bolivia:				
La Paz	June 1–30		1	
Bulgaria				Mar. 1–Apr. 30, 1926: Cases, 64; deaths, 12.
Chile:				
Antofagasta	May 23–June 26	4		
Do	June 27–July 3	1		
Valparaiso	Apr. 29–May 5		1	
China:				
Antung	June 14–27	7	1	
Do	June 28–July 18	14	1	
Canton	May 1–31	1		
Ichang			1	Reported May 1, 1926. Occurring among troops.
Wanshien				Present among troops, May 1, 1926. Locality in Chungking consular district.
Chosen				Feb. 1–Apr. 30, 1926: Cases, 640; deaths, 66.
Chemulpo	May 1–June 30	38	2	
Gensan	June 1–30	1		
Seoul	do	8	3	
Czechoslovakia				Jan. 1–May 31, 1926: Cases, 154; deaths, 4.
Egypt:				
Port Said	June 4–24	4	1	
Do	July 9–15	3	1	
Cairo	Jan. 29–Feb. 18	8	4	
Great Britain:				
Scotland—				
Glasgow	July 30–Aug. 7	9		In same family.
Ireland (Irish Free State):				
Cobh (Queenstown)	May 30–June 5	1		
Do	June 27–July 3	1	1	
Cork	June 5	1		
Kerry County—				
Dingle	June 27–July 3	1		

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

Reports Received from June 26 to September 3, 1926—Continued

TYPHUS FEVER—Continued

Place	Date	Cases	Deaths	Remarks
Italy				Mar. 28–May 8, 1926: Cases, 3.
Japan				Mar. 28–May 29, 1926: Cases, 37.
Latvia				May 1–June 30, 1926: Cases, 19.
Lithuania				Mar. 1–May 31, 1926: Cases, 172; deaths, 21.
Mexico				Feb. 1–Mar. 31, 1926: Deaths, 73.
Durango	July 1–31		1	
Mexico City	May 16–June 5	20		Including municipalities in Federal District.
Do	June 13–19	9		Do.
San Luis Potosi	June 13–26			Present, city and country.
Morocco				Mar. 1–May 31, 1926: Cases, 414.
Palestine				March, 1926: Cases, 6. Exclusive of Bedouin tribes and the British military forces.
Gaza	July 6–12	1		
Haifa	July 13–19	1		
Jaffa District	June 15–28	5		
Majdal District	July 13–19	1		
Nazareth District	do	3		
Peru:				
Arequipa	Jan. 1–31		2	
Poland				Mar. 28–June 26, 1926: Cases, 1,272; deaths, 85.
Rumania				Mar. 1–Apr. 30, 1926: Cases, 395; deaths, 49.
Russia				Jan. 1–Mar. 31, 1926: Cases, 14,814.
Tunisia				Apr. 1–June 30, 1926: Cases, 110.
Tunis	June 11–30	3		
Turkey:				
Constantinople	June 16–22	1		
Union of South Africa				Apr. 1–May 31, 1926: Cases, 153; deaths, 19.
Cape Province				Apr. 1–May 31, 1926: Cases, 116; deaths, 15. Native.
Do	May 31–July 3			Outbreaks.
Glengray District	June 27–July 3			Do.
Grahamstown	do	1		Sporadic.
Natal				Apr. 1–May 31, 1926: Cases, 17. Native.
Orange Free State				Apr. 1–May 31, 1926: Cases, 15; deaths, 1.
Do	June 6–12			Outbreaks.
Transvaal				Apr. 1–30, 1926: Cases, 3; deaths, 3. Native.
Walkkerstroom district	June 20–26			Outbreaks.
Wolmaransstad district	do			Do.
Yugoslavia				Apr. 15–June 30, 1926: Cases, 48; deaths, 7.
Zagreb	May 15–21	1		

YELLOW FEVER

Place	Date	Cases	Deaths	Remarks
Brazil	Reported June 26			Present in interior of Bahia, Pirapora, and Minas.
Bahia	May 9–29	4	3	
Do	June 6–26	6	4	
Gold Coast	Apr. 1–10	3	1	

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